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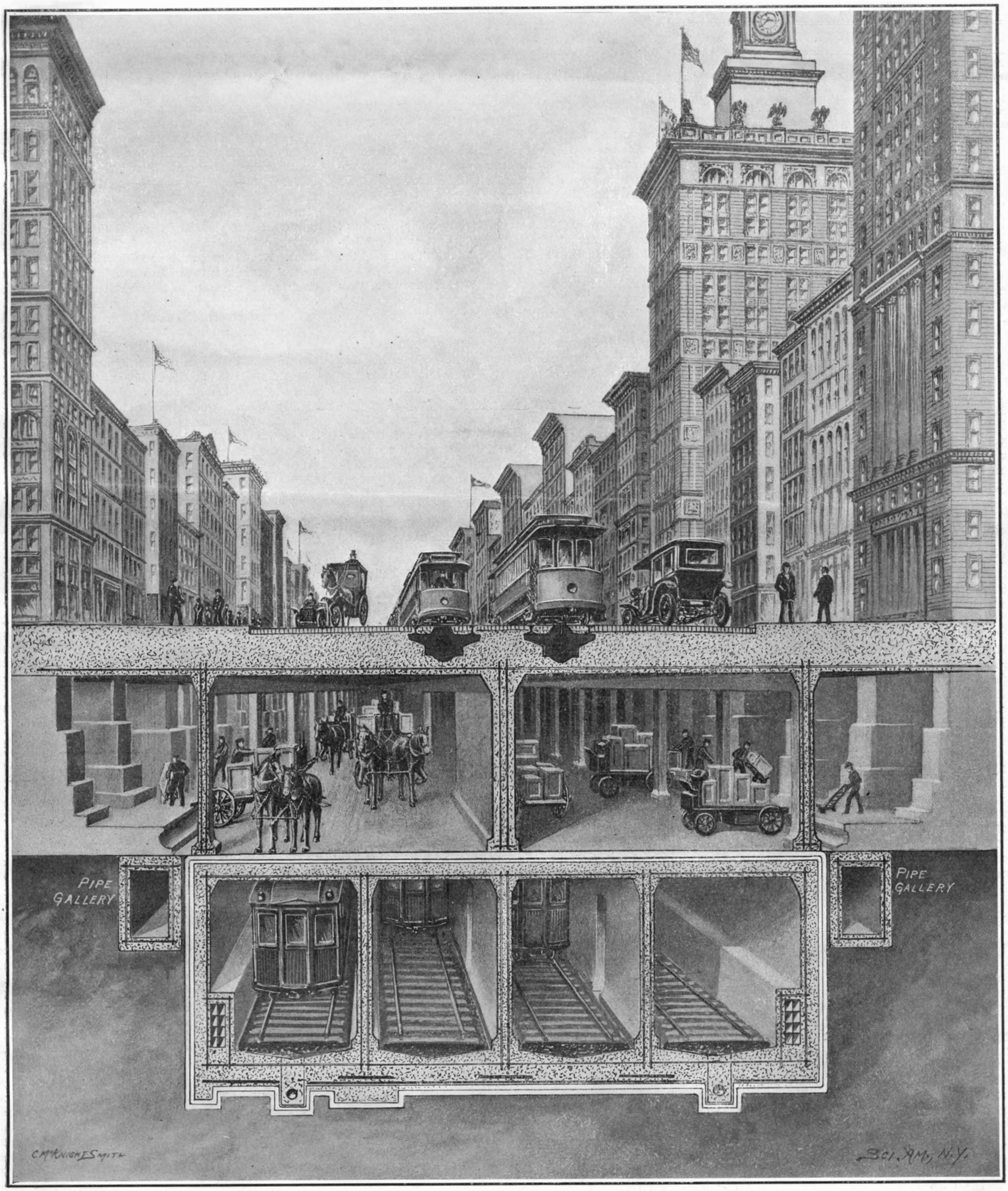
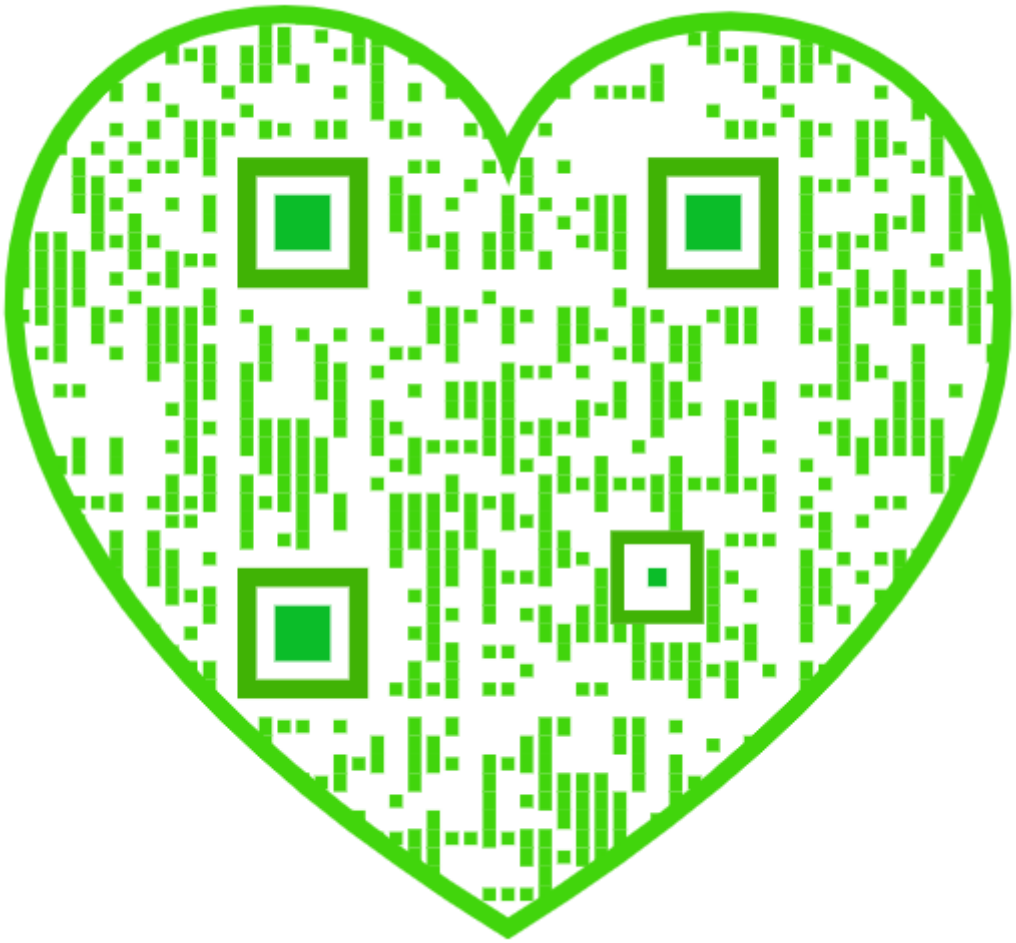


The present congestion is caused mainly by the presence of slow-moving trucks and delivery wagons. By the construction of a trucking subway, freight could be delivered direct into the basements, and the streets reserved for the street cars and light vehicles.

DOUBLE-DECK STREETS—A RELIEF FOR TRAFFIC CONGESTION.—[See page 510.]



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NEW YORK, SATURDAY, JUNE 22, 1907.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

HOW THE LAW MAY PREVENT RAILROAD ACCIDENTS.

The president of one of our leading railroads, who has risen to his present position by steady advancement from the ranks, recently told the writer that in a last analysis of the causes of railroad accidents he was convinced, as the result of his long experience, that it was to be found in the lack of discipline; the disposition to play fast and loose with established rules. In proof of this, he cited the fact that as the result of a journey which he had recently taken through Europe, during which he investigated the signal systems on several of the roads which have shown a remarkable immunity from accident, he was surprised to find in how many cases these systems were inferior to those which were installed on some of the leading American railroads, including his own. And yet, in spite of superior protective appliances, the list of casualties was much larger on our roads in proportion to the number of passengers carried. The question of the enforcement of discipline by the strict imposition of penalties was rendered difficult, according to this authority, by the action of the various labor associations which, in their zeal to protect employees (a zeal perfectly proper when exercised with due discretion), too often demanded the reinstatement of those who had been proved guilty of flagrant disobedience to established rules. Moreover, it would happen, in cases in which the management was prepared to fight out a contested case on a point of principle, that an intimation would be quietly conveyed from Wall Street, to the effect that under no conditions was a strike to be precipitated, at least for the time being.

Without entering into the merits of the case as thus presented, it is certain that such a condition of things is full of frightful menace to the safety of the traveling public; and the question may well be asked, whether some higher power may not be invoked to deal with the situation. Such an opportunity is, of course, presented when accidents involving the death and injury of the passengers or employees occur; and a case has recently been brought to our notice in which the criminal negligence of an employee was visited with immediate and severe punishment, and steps were taken to prosecute the company for operating their railroad under laws which, by rendering such an accident possible, were a constant menace to the safety of the public.

The case in question was a head-on collision which occurred last year on the Grand Trunk Railroad. The coroner's jury found the engineer and the conductor of the train, who had overlooked the train with which it had collided, responsible for the accident, and in the subsequent trial the defendants were charged with the death of the employees who were killed, and also with violating the rules of the company. The jury found them guilty on the second count. The judge threw aside the plea that the conductor had worked overtime, and sentenced him to three years' imprisonment. In imposing sentence he said that, if the accident were the fault of the rules and regulations of the railway company, then terrible was the guilt of those responsible for such rules and regulations. "Much of the slaughter, however," said the judge, "is due to the sheer neglect and downright and inexcusable carelessness of those who are intrusted with the carrying out of these rules and regulations; and if you and your fellow trainmen had used even ordinary care, the three men now lying in the grave as the result of your act might now be happy and useful citizens." It was shown that the conductor had been working from nineteen to twenty hours a day, for which he received about forty dollars a week; but that these long hours of work were optional, and that he was entitled, under the rules, to a rest of eight hours.

Referring, on the other hand, to the responsibility of the railroad company, the judge said: "To my mind, the persons who even permitted you to work from nineteen to twenty hours a day, day after day, five days of the week, were guilty of a gross wrong; the persons who made the rules and regulations under which this was possible are themselves almost as guilty, morally, perhaps legally, as yourself in the death of these three victims. I shall cause to be sent to the Crown authorities a copy of the proceedings of this trial, with the recommendation that all proper investigations be made, and that the persons responsible, no matter what their position may be, be proceeded against so far as the criminal law permits."

Although the penalty inflicted in the present case may seem to have been severe, it cannot be denied that one of the most effective "safety appliances" for the prevention of the unnecessary and shocking list of railroad fatalities and casualties, could be found in the swift and impartial action of the law, in every case where the death or injury of passengers or employees can be shown to be the result of faulty regulations on the part of the companies, or of inexcusable carelessness on the part of the employees.

WE BUILD A LOCOMOTIVE ON THE METRIC SYSTEM.

The opponents of the introduction of the metric system into America have asserted that its use would involve endless confusion in our mills, machine shops, and other industrial establishments in which the operatives have been accustomed all their lives to the use of the English measurements. It has been claimed that the change would so thoroughly disorganize the working forces, that it would involve many months of time, and a great loss of money, to get any establishments that made the change into the full swing of the new conditions.

The Baldwin Locomotive Works, however, has proved that in this case, at least, "an ounce of fact is worth a ton of theory"; for they have recently completed twenty locomotives for the Paris-Orleans Railway of France, which were built entirely from drawings made on the metric system and furnished by the railway company themselves. Of course, this is not the first time that work has been done in this country under the metric system of measurement and computation; but the successful execution of such a large order must certainly be regarded as a strong indorsement of the system as tried under American shop conditions. We are informed that not only have the locomotives fulfilled strictly the requirements of the specifications, but that the officers of the company were favorably impressed with the working of the new system.

BRUNEL AND THE SEVEN-FOOT GAGE.

When that far-sighted engineer Brunel built the Great Western Railway in England with a gage of seven feet, he aroused a storm of opposition among his brother engineers, the great George Stephenson being one of his most active opponents. Stephenson, for no better reason, apparently, than that it was the established English wagon gage, adopted 4 feet 8½ inches as the distance between the inside edges of the rails of his "narrow gage" railroads. Brunel, on the other hand, possessed as he was of what almost might be called a prophetic instinct, built for the future, whether he was engaged on the problem of transportation by sea or by land. His "Great Eastern" steamship was not exceeded in dimensions until the advent a few years ago of the White Star liner "Oceanic," and his 7-foot gage on the Great Western Railway maintained itself for half a century, giving most excellent results, in spite of the fact that the "battle of the gages" had been won by Stephenson with his narrow-gage roads, almost at the very outset.

The vindication of Brunel's foresight has been complete. If we take half a dozen of the latest of the transatlantic liners, we find that they are approximately of the same size, if not larger than, the "Great Eastern," while it was only the other day that the most prominent railroad magnate in this country stated publicly that the 4 foot 8½ inch gage was too narrow for present requirements, and that a broad gage of 6 or 7 feet must ultimately be adopted. This statement was prompted by consideration of the fact that many of the main lines of this country are heavily congested, and are unable to handle promptly the enormous and ever-increasing amount of freight that is delivered to them.

It is a fact that, were it not for the enormous expense which would be entailed in the widening of the gage of our leading roads, seven feet would be an immediate solution of the difficulty of congestion; for with the wider gage it would be possible, without making any increase in the number of train movements, to increase the carrying capacity of the roads fully fifty per cent. It is the narrowness of the present gage which limits the size and power of the locomotive; for the dimensions of boiler and cylinders have been increased until they have reached the limits of the height and width of tunnels and bridges. With an increase of width of gage of fifty per cent, and a corresponding increase in the allowable height of locomotives and cars, it would be possible to build locomotives of more than double the power of the largest at present in use. This change, however, would involve the rebuilding of every tunnel, viaduct, bridge, and station platform throughout the whole length of the line so changed. Moreover, the enormous increase in the axle loads would necessitate the construction of an entirely different type of track from that which is now used—which, by the way, would be "a consummation devoutly to be wished." The present cross-tie, tee-rail, and spike method of track building is pitifully inadequate, even for present conditions; and if a 7-foot gage were used, some new form of track, with continuous longitudinal girders and heavy rail sections, would have to be built. In this connection it is interesting to note that Brunel adopted a longitudinally-supported track for his Great Western road. Though the change may not come in the present generation, the day is undoubtedly approaching when the engineers of the future will widen the gage, being driven to it by the stress of stern necessity.

ANOTHER LONG-DISTANCE TRANSMISSION IN CALIFORNIA.

The State of California has won another recognition of the enterprise which she has shown in overcoming the difficulty of the scarcity and high cost of fuel by utilizing the energy which is stored in the waters of the far-distant Sierra Nevada Mountains. At the beginning of the present century, as shown by the United States Census, she led the world in the number and daring of her long-distance hydro-electric transmissions. Notable among these is the plant by which, for several years, San Francisco has been supplied with electric power transmitted from water sources situated over 200 miles away from the city.

The most recent addition to these systems consists of the transmission of 25,000 horse-power for a distance of 117 miles, from the Kern River to the city of Los Angeles, at the extremely high pressure of 85,000 volts. This is the first installment of a total transmission of 60,000 horse-power, which is ultimately to be developed from that river and transmitted to Los Angeles. The water is deflected from the river and carried through the mountains and hills for a distance of 8 2-3 miles by means of twenty concrete-lined tunnels. It is then conducted down the slope of the mountain, through a total fall of 877 feet, to the power house, where, at a pressure of 400 pounds to the square inch, its energy is developed on eight impulse wheels, which serve to drive the generators. It is stated by the local president of the Edison Electric Company, which is carrying on the work, that there is no other community in the country in which the consumption of electricity per capita is so high as in Los Angeles, and that, with the exception of certain districts in the natural gas belt of the Middle West, there is no locality where the rates for power are cheaper. As showing the economy which is rendered possible by the great fall available in these mountain power plants, it may be mentioned that the conduit for conveying the water measures only 9 feet in height by 8 feet in breadth, and that the maximum interior diameter of the concrete-incased steel tube from the tunnel to the power station below is only seven and a half feet.

TINOL.

A new method of soldering has been brought out by a German company at Bonn which is claimed to be much superior to the present way of soldering with tin. Seeing that the quality of the joint depends largely upon the way in which the surfaces have been cleaned, great care must be given to this operation, and this is not always easy in the case of complicated pieces. Cleaning is usually done by acids, zinc chloride, sal ammoniac, etc., which have an acid reaction and leave traces of oxidation after the soldering. This may be a disadvantage, and in fact for electrical work the method of soldering by rosin must be used in many cases, in spite of the drawbacks which it has. As to the new solder, it is in the form of a paste which is more or less consistent, according to the needs. It contains the cleaning substance in itself and the soldering can be done without any previous cleaning. The paste is spread upon the metal surfaces and these are heated with the iron or by a lamp or furnace. For small pieces a candle flame is even enough. The substance is composed of lead and tin in fine powder, which is obtained by a patented process. A stream of metal coming from a nozzle is pulverized by compressed air or steam. The powder is then mixed with chloride of zinc or other similar reducing substances which are made fluid by adding glycerine, vaseline, etc. Consistence is given the paste by using cellulose, which burns without residue. These components are chosen so that when the paste is heated the metal melts first and appears as liquid drops in the midst of the medium and the latter is not altered, also protecting the metal from oxidation. Then these bodies decompose in turn, cleaning the metal and al-

lowing the solder to assemble and run upon the cleaned and protected surfaces. There is no acid reaction and the joint is very clean. It is somewhat dearer than the ordinary solder, but there is an economy in heating and in the use of the paste, as it avoids drops of solder. Proportions varying from 20 to 100 per cent of tin are used. One variety flows easily and can be put on with a brush, while the other kind is more solid. A good application is for fixing nuts upon bolts. Some of the compound is brushed into the thread, the nut screwed on and then heated when in place. Bolts of 0.4 inch diameter thus soldered could be broken by twisting before the nut could be unscrewed. Heating again will release the nut from the bolt. Tests show the mechanical and electric resistance to be in favor of the new method. The prepared substance is known as "tinol."

A TELEPHONE NEWSPAPER.

BY W. G. FITZ-GERALD.

If the dreamy, ease-loving Lotophagi of Homer ever had a newspaper, it was surely on the lines of Budapesth's "Telefon-Hirmondo," or "Caller of the News." For here we have a "newspaper" with only an abstract existence; its soul poured into the listener's ear as he sits half dozing in a big armchair by the fire on weekday or Sunday.

Far from being the fad of a moment, the "Telefon-Hirmondo" has all the attributes of a great daily journal save mere concrete type, ink, and paper. It has a staff of over two hundred people in the busy winter months, and its circulation falls only when the editor-in-chief or his "stentors" slack off a little in their ceaseless stream of eloquence, wherein are queerly mingled events fraught with the rise or fall of nations and "ads" of soap and pills!

Its inventor was the Hungarian electrician, Theodore Puskas, an ex-collaborator with Edison. Mr. Puskas died three months after the practical realization of what had been his life's dream. He saw his beloved "News Teller" cautiously installed with 43 miles of wire; now it has 1,100 miles, forming a veritable web, pulsing with the world's doings and radiating into more than 15,000 of the best homes in the Hungarian capital.

Readers of Bellamy's "Looking Backward" will remember one of his boldest conceptions was a speaking, singing, lecturing, educating, and concert-giving "newspaper." I think it will come as a surprise to most people to hear that this fantasy has been in active operation in Budapesth for a long time as a proved success, placing the famous and lively city of 800,000 ahead of the world.

From eight in the morning till ten at night eight loud-voiced "stentors" with clear vibrating voices literally preach the editor-in-chief's "copy" between a pair of monstrous microphones, whose huge receivers are facing each other. The news is of all kinds—telegrams from foreign countries; theatrical critiques; parliamentary and exchange reports; political speeches; police and law court proceedings; the state of the city markets; excerpts from the local and Viennese press; weather forecasts—and advertisements.

But the "Telefon-Hirmondo" goes far beyond the routine of an ordinary newspaper, as its remarkable constitution enables it to do. At stated hours concerts, performances at the Imperial Opera or municipal theaters are heard by subscribers in their own dining rooms, or as they sit by the fire playing cards on a winter's evening. Eminent divines, lecturers, and actors preach, address, or tell stories to enormous audiences scattered all over the beautiful city.

Subscribers even hear a list of strangers' arrivals, with the correct astronomical time and an exhaustive list of amusements such as may well tempt them from their own hearth. The exact time of each news item is strictly regulated and announced to subscribers every morning. Thus each need only listen to the news that interests him, and he can always be sure of its being "on tap" at the moment predicted.

In the event of some ultra-important item coming to hand suddenly—a disaster of international moment, an outbreak of war, or the like—it is instantly shouted into the microphones by the stentors, and special alarm signals ring in every household. When I called upon the editor at the administrative offices of the "Telefon-Hirmondo," I took careful note of a typical day's programme, and here it is:

A. M.

9:00— ..Exact astronomical time.
9:30—10:00..Reading of programme of Vienna and foreign news and of chief contents of the official press.
10:00—10:30..Local exchange quotations.
10:30—11:00..Chief contents of local daily press.
11:00—11:15..General news and finance.
11:15—11:30—Local, theatrical, and sporting news.
11:30—11:45..Vienna exchange news.
11:45—12:00..Parliamentary, provincial, and foreign news.
12:00 noon ..Exact astronomical time.

P. M.

12:00—12:30..Latest general news, parliamentary, court, political, and military.
12:30— 1:00..Midday exchange quotations.
1:00— 2:00..Repetition of the half-day's most interesting news.
2:00— 2:30..Foreign telegrams and latest general news.
2:30— 3:00..Parliamentary and local news.
3:00— 3:15..Latest exchange reports.
3:15— 4:00..Weather, parliamentary, legal, theatrical, fashion and sporting news.
4:00— 4:30..Latest exchange reports and general news.
4:30— 6:30..Regimental bands.
7:00— 8:15..Opera.
8:15 (or after the first act of the opera)..Exchange news from New York, Frankfort, Paris, Berlin, London, and other business centers.
8:30— 9:30..Opera.

And once a week special lectures or concerts are given for the children. For a very different class of "reader," or rather listener, are reports of all the principal Hungarian and Austrian horse races, flashed over the wires the moment results are known.

The "Telefon-Hirmondo" has proved a real boon to this great city. For one thing it gives news of great importance far sooner than any printed daily can put it before the public. It is the delight of women and children, and is a real entertainment to the sick in their homes, to patients in hospitals, the blind, and all those who have neither time nor money to go to theater, concert, or opera.

And the most unique journal in the world is invariably "turned on" in the doctor's waiting room, in barber shops, cafés, restaurants, and dentists' parlors—wherever people resort, in fact, and sit waiting for any purpose whatever. And obviously, since the journal costs little to produce, its service is quite extraordinarily cheap. Each subscriber pays but two cents a day for receiving, as it were, orally in his own home, the news of the entire world, besides entertainment which might very well cost him several dollars a day.

No fees are charged for fitting up the receivers in a house; and should a subscriber wish the "paper" discontinued, he can ring off, as it were, after a four months' trial. Each station is provided with a receiver having two ear tubes, so that husband and wife, brother and sister, or a couple of children can listen at the same time. And the apparatus can be fixed wherever the subscriber wishes—at bed or sofa, writing desk, fireside, or study.

No more interesting experience can be imagined than a visit to the editorial offices, where the readers, lecturers, and singers are communicating their various departments into the big microphones. Piano music is played on a grand of enormous power and size, on which the telephonic appliance is fixed. For orchestral music there are special transmitters with sound funnels four feet in diameter. The staff consists of two business managers, two principal editors, six subeditors, twelve reporters, and the eight stentors—these last with voices which the old Romans themselves might have envied in forum or assembly.

So loudly do they shout the news of the world, that a "solo" of ten minutes quite exhausts the strongest. The company owning the newspaper has its own wires, and property owners have no right to make any charge for wires fixed upon their houses. I suggested to the managing editor that his position was unique in the journalistic world.

"True," he said smilingly; "we take no side, have no editorial opinions, simply because we have no leading articles."

"How do you manage your advertising?" I asked him.

"When an advertisement is transmitted over the wires," he replied, "it is sandwiched between two particularly interesting items of news, and so commands special attention. Our advertising charges as a general rule are fifty cents for twelve seconds of the stentor's voice."

"And here," the editor went on to say, "is the copy in Magyar of a Maurus Jokai *feuilleton*, two or three chapters of which have already been given. And so interested and excited are our subscribers, that they keep ringing us up—especially the children—asking when the stentors will get busy again unraveling a complicated and thrilling situation.

"We realize the responsibility of our position, and all our editorial staff, from editors to stentors, are most careful to tone down, alter, and omit items of news which might in any way be objectionable when delivered into the home.

"I have often marveled," the editor concluded, "why a country like America with its amazing enterprise and development has not produced a 'Telefon-Hirmondo' of its own on a far vaster scale than Budapesth could possibly manage. You Americans like novelty; your advertisers are enterprising above all others. Possibly before long New York and Chicago, Philadelphia, Boston, and San Francisco will each have a 'Telefon-Hirmondo' of its own, bringing enormous profits to their owners. For all kinds of expenses are eliminated from the cost of production, such as paper, ink, typesetting, and a great and expensive staff."

RESULT OF THE MOTOR BOAT RACE TO BERMUDA.

The two motor boats, the "Ailsa Craig" and the "Idaho," which left New York on the afternoon of June 8 for a long-distance race of 670 nautical miles to Bermuda, arrived at their destination on the 11th instant after a very successful trip. As was to be expected, the 75-horse-power "Ailsa Craig" beat the 25-horse-power "Idaho" by a considerable margin. The elapsed time of the two boats was 65 hours and 49 minutes and 75 hours and 2 minutes respectively. The larger and more powerful craft beat the smaller boat, therefore, by 9 hours and 13 minutes, but as she was obliged to give the "Idaho" 8 hours 56 minutes and 38 seconds time allowance, she was declared the winner by 16 minutes and 22 seconds only. Her average speed throughout the entire distance was about 10.18 knots, while the "Idaho's" average speed was 8.92 knots. Fair weather was met nearly the whole distance, and it was only during the last night of the trip that the boats encountered strong westerly winds and high seas. The "Ailsa Craig" stopped her engine only once for a few minutes, for the purpose of adjusting an igniter. Only 550 gallons of gasoline were consumed by her engine in making the run. Both boats showed themselves to be stanch and seaworthy craft. The voyage brought out one point about sea-going gasoline cruisers, namely, that the engine room should be entirely separated from the habitable part of the boat, and should have especially good means of ventilation. Doubtless another year a considerably greater number of cruisers will participate in the race.

AUTOMOBILE RACES AND RECORD RUNS.

By far the boldest and longest transcontinental automobile race thus far attempted is the 9,300-mile endurance trip from Peking, China, to Paris, France, which was started on June 10 from the former city. Five touring cars and a tri-car are the contestants. These consist of two De Dion-Bouton touring cars and a Contal tri-car representing France, a Spiker touring car representing Holland, and an Itala touring car representing Italy and driven by Prince Borghese. The contestants were given a splendid send-off by the foreign ministers and residents of Peking. They expect to average something less than 100 miles a day.

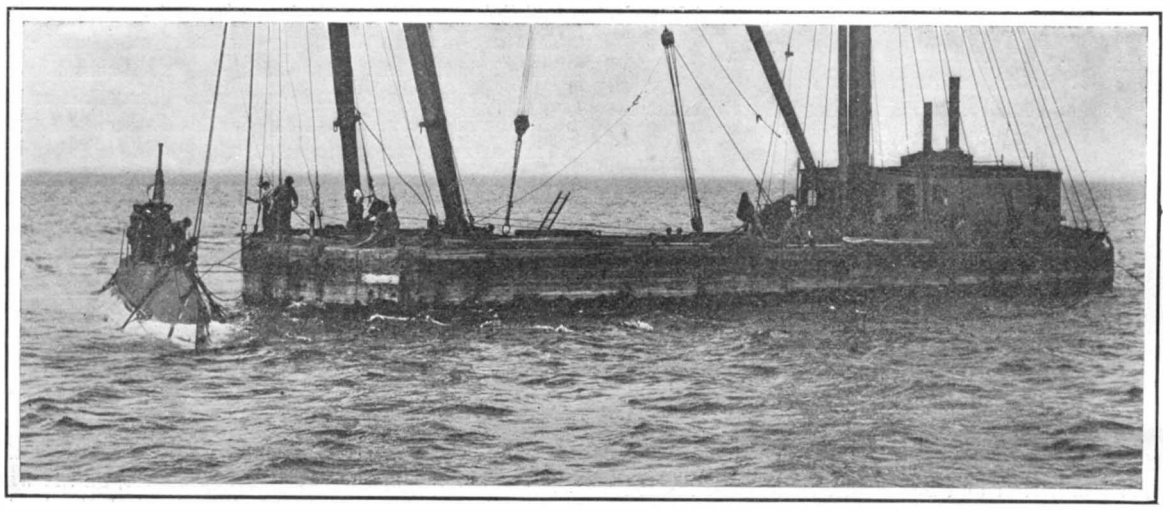
To Walter Christie belongs the honor of being the only American to compete in the French Grand Prix automobile race, which will be run on the Dieppe circuit, on July 2. Mr. Christie's well-known front-drive racer has been thoroughly rebuilt and reconstructed since the last Vanderbilt race. The final tests of it, which were made on Long Island, previous to its being shipped abroad, showed that it was capable of a speed of 90 miles an hour, which would enable it to hold its own with any of the high-power foreign racing cars. We sincerely hope that Mr. Christie will meet with better luck this time than has been his lot heretofore.

The second great international race of the year—the 310½-mile race for the Emperor's Cup—was held on the Tanus circuit near Homburg, Germany, on the 14th instant. As there were 92 entries, two 155-mile elimination races were run off on the day preceding, in order to eliminate half of the competitors. In the race itself, French, Italian, Belgian, English, Austrian, German, and Swiss cars participated. The winner was Nazzaro on an Italian Fiat racer. A Belgian Pipe car was second, and a German Opel-Darracq third. The times and average speeds of the first three cars were: (1) 5 hours, 34 minutes, 26 seconds (55.76 miles an hour); (2) 5 hours, 39 minutes, 10 seconds (54.92 miles an hour); (3) 5 hours, 39 minutes, 59 seconds (54.82 miles an hour). The best time made in the elimination races was two circuits of the course (155.25 miles) in 2:50:20, which corresponds to an average speed of 54.68 miles an hour.

A helio-chronometer designed by Messrs. Pilkington & Gibbs, Ltd., gives Greenwich mean time by a simple direct solar observation. It comprises devices for adjustment in latitude, longitude, level, and azimuth. It is self-correcting for the equation of time by means of a disk divided and engraved to show the month and day; the disk can be turned to indicate the current date. The underside of the disk is a cam formed to represent the equation of time plotted as a polar curve and touching the cam is a lever carrying the upper pierced screen through which the sun can throw a spot of light on to the center line of the lower screen, the dial being turned about the polar axis to permit this. The imaginary mean sun is therefore advanced or retarded from the apparent sun by the amount requisite to cause the instrument to indicate Greenwich mean time correct to a few seconds.

THE GOVERNMENT TESTS OF SUBMARINES.

Particular interest attaches to the government tests of submarines, which have been carried on during the past few weeks by a board of naval officers of which Capt. Adolph Marix is president. Not only are two distinct types of submarine, larger, faster, and in every way more efficient than their predecessors, being put through a series of tests far more searching than any previously attempted, but upon the result of these trials depends the placing of contracts for the construction of as many new boats of this type as can be built for three million dollars—the sum of money appropriated for this purpose at the last session of Congress. The principal firms that tendered at the opening of the bids last month were the Electric Boat Company, of New York, the Lake Torpedo Boat Company, of Bridgeport, Conn., and the Burger Subsurface Company, also of New York.



The "Octopus" Being Lowered by a Lighter Derrick to a Depth of 205 Feet.

The Electric Boat Company, which has constructed the only submarines which are in actual service in the United States navy, submitted bids for two types of boats similar to the "Octopus," which is now in commission, and is at present being used in the competitive tests above referred to. The Lake Torpedo Boat Company submitted bids for five different sizes of boats, ranging from 235 tons to 500 tons displacement, and costing from $193,000 to $450,000 each. The Burger Subsurface Company proposed to construct a 250-ton subsurface boat, with a maximum speed of 19 knots, at a cost of $250,000, and pledged themselves to have the vessel ready within twelve months. This company, however, was not prepared to submit a vessel of their type for test, but were permitted by the Navy Department to enter in the trials a large model built to a one-fourth scale.

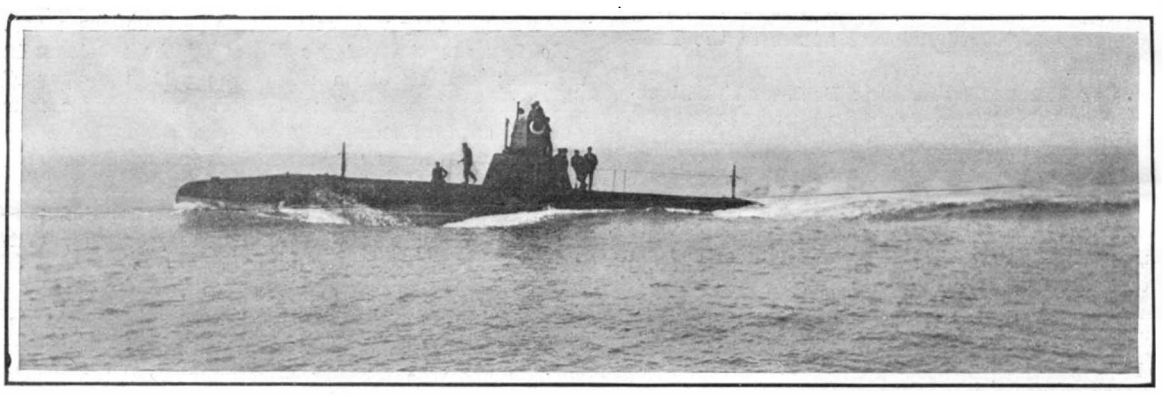
The Electric Boat Company's submarine, the "Octopus," is of the same general type as the Holland boats now in service of our navy, which are 63 feet long, 12 feet in diameter, and have a submerged displacement of 120 tons. The "Octopus" is one of four sister boats which have lately been completed, the others being known as the "Cuttlefish," "Tarantula," and "Viper." She is 105 feet long, 13.5 feet in diameter, and displaces 200 tons. In the design of the "Octopus" are embodied the lessons which have been learned in the operation of submarines, both in our navy and abroad. Particular attention has been paid to structural strength, and both in scantling and in plating she is a very much stiffer and stouter boat than her predecessors. It will be remembered that in the fatal accidents which have occurred in the French and English navies, where the submarines have sunk to great depths, the hull structure has shown signs of failing under the enormous pressures developed, the hulls becoming distorted, and leaks developing, both at the seams and at the outlets of pipes and other openings.

One of the most severe tests to which the new submarines were subjected was that of sinking them to a depth of 200 feet, and allowing them to remain at that depth for a specified length of time, to determine whether they were sufficiently stout and watertight to endure the great pressure of the water. In one test the Lake torpedo boat voluntarily sank to the bottom at a depth of 138 feet, and remained there for a short while with her crew aboard, returning to the surface in about five minutes after disappearing from view. While resting on the bottom she was subjected to a pressure of 52 pounds to the square inch at the axis of the boat, and she is said to have withstood this enormous pressure perfectly. One of our illustrations shows a similar, but even more severe, deep-water test of the "Octopus," when she was lowered to the bottom of the ocean to a depth of 205 feet at a point five miles northeast of the Boston light. After all openings had been carefully closed she was swung upon chains from a lighter, and with her ballast tanks filled with water, was lowered slowly to the bottom, where she was allowed to remain for ten minutes. Although the total pressure at this depth, over the whole surface of the boat, must have amounted to about 15,000 tons, it was found by the members of the Board, who made a careful examination after she had been hauled to the surface, that her structure had suffered no damage, and that there was no evidence of leaks having developed.

The "Octopus" is of what is known as the "diving" type, and the "Lake" as the "even-keel" type of submarine. When the "Octopus" is to be submerged, water is taken into the balance tanks until she has a reserve buoyancy of about 800 pounds. Then with the propellers in motion, and the ballast tanks loaded until the boat has an inclination of about 8 degrees from the horizontal, the horizontal rudders are inclined, and the vessel dives. To maintain submergence after reaching the desired depth, the vessel maintains a downward inclination of about 3 degrees.

The "Lake" is 85 feet long and has a submerged displacement of 250 tons. Unlike the "Octopus," she submerges without changing her horizontal trim. Water is admitted to the ballast tanks until the craft is awash, and then the hydroplanes or horizontal steel rudders at the sides of the vessel are tilted to the desired angle, when the water, impinging upon them, serves to drive the boat under.

In the speed tests on the surface and submerged, the "Octopus" in a series of runs on the surface, averaged 11.95 knots with her 500 horse-power gasoline engines, and when submerged she made 10 knots with her electric motors of 230 horse-power.



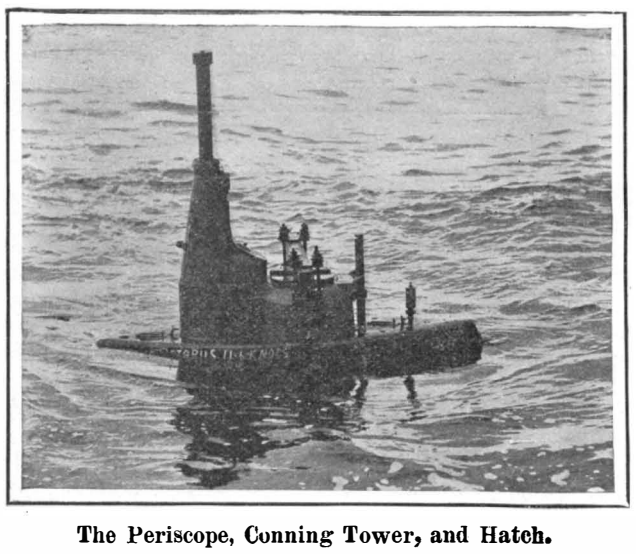
The "Octopus" Making 12 Knots Under Her Gas Engines at the Surface.

Scientific American Medal.

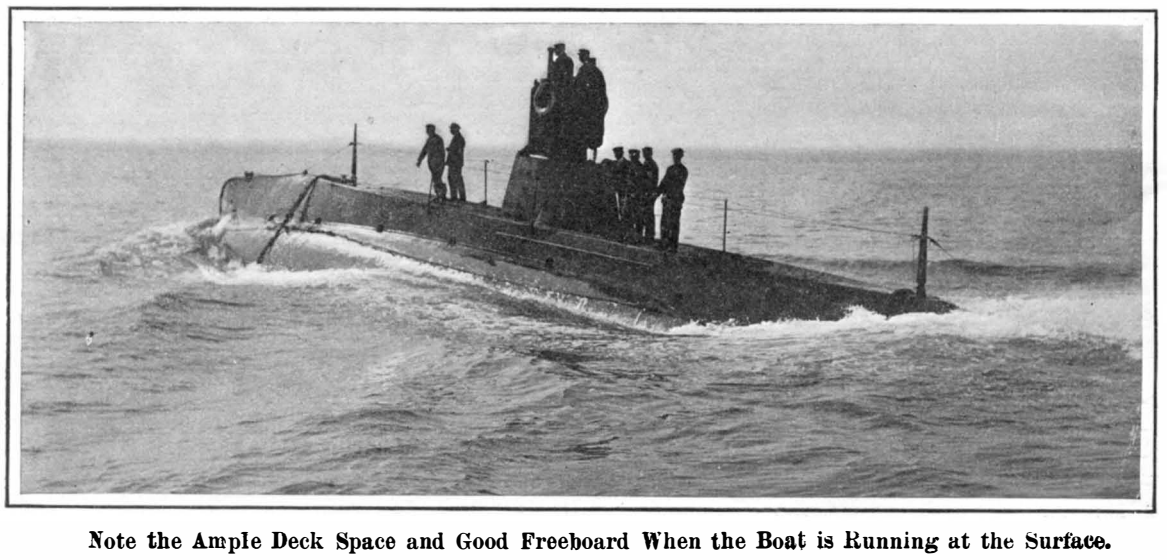
The SCIENTIFIC AMERICAN medal which is to be awarded annually for safety devices under the direction of the American Museum of Safety Devices and Industrial Hygiene, is almost completed and a reproduction of the same will be given at an early date. The jurors thus far requested to decide upon the awarding of the medal and who have accepted are John Hayes Hammond, president of the American Institute of Mining Engineers; Samuel Sheldon, president of the American Institute of Mechanical Engineers; H. H. Westinghouse, and Stuyvesant Fish. All of these gentlemen are pre-eminent in their professions and it is very gratifying to know that the award will be made by such highly competent jurors.

A New Wall Covering.

A new wall covering called "metaxin" has been invented in Germany. This new wall paper has the appearance of a silk fabric, and has some similarity with the Tecco and Salubria wall papers, but through the peculiarity of its manufacture much greater effects can be obtained, especially as regards the silky appearance and brilliancy. The fact that through forcing dissolved wood pulp through fine openings and afterward drying it in a certain manner a substitute for natural silk can be manufactured, forms the basis for the making of the new wall covering "metaxin." The threads surpass in brilliancy natural silk. For several years the experiments were carried on, but for a long time without success, the result being not artificial silk, but very shiny paper. The great importance of the newly-discovered wall covering, however, lies in the serviceable qualities of wood pulp. The stuff is laid upon a material specially suited for wall paper, such as paper, cotton, and such like, and it soon forms a firm layer which has a bright silky gloss and is so thick that one cannot distinguish the material underneath. The silk layers adhere firmly to the material they are put on, and cannot be scratched or rubbed off. It resists the effect of soda or any other acids or alkalies; like all wood pulp it is absolutely proof against wet. The "metaxin" takes any color. It is little or not at all affected by the heating apparatus, never turns black, and having an entirely closed surface, "metaxin" has the advantage of not harboring dust or germs of diseases.



The Periscope, Conning Tower, and Hatch.



Note the Ample Deck Space and Good Freeboard When the Boat is Running at the Surface.

THE GOVERNMENT TRIALS OF THE NEW U. S. SUBMARINE "OCTOPUS."

THE WELLMAN POLAR AIRSHIP EXPEDITION.

BY THE PARIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Should Mr. Walter Wellman succeed in reaching the North Pole with his new airship, his performance will be counted as one of the great achievements of the age, and that he has a reasonable chance of doing so will seem apparent to any one having knowledge of aerial navigation work, after examining the problem and also the means provided for its solution. It is to be noted that Mr. Wellman is an experienced Arctic explorer, who has made several trips to these regions, and has reached as high as 81 deg. latitude; but like all the others, he did not succeed in attaining the coveted point. However, he acquired a great knowledge of the country and the conditions which were to be met with; and, being of a serious and practical, as well as of an energetic and daring nature, he desired to make use of the advanced state of aerial navigation, and considered that the time was now ripe for making a flight to the Pole in an airship. Last year he started from Paris for Spitzbergen at the head of the Wellman Chicago Record-Herald Expedition in order to establish his headquarters there. At the same time he had an airship built at Paris, but it had to be made in such haste in order to arrive by the short Arctic summer, July and August (which are the only months fitted for the trip) that the mechanical part was found unsatisfactory. However, he built a vast balloon shed and prepared for this year's work. He was fortunate in securing the co-operation of Mr. Melvin Vaniman, an experienced engineer, who undertook to redesign the nacelle and modify the balloon to some extent.

Stated most briefly, what the party wish to do is to start from Spitzbergen, at a distance of 618 statute miles from the Pole, and make the trip to the Pole and return, a total distance of 1,236 miles. Using a speed of 15 miles an hour for calm weather, with the fuel they carry they will be able to cover a distance of 2,250 to 2,700 miles, which leaves them a large margin. During the months of July and August the temperature in the polar region is not very much above the freezing point, and in many respects the region is more favorable for airship work than other latitudes, owing to the more constant conditions of weather which prevail. The ice fields allow the use of the guide rope, which is a great point.

From data obtained from observations on the "Fram" during her three years' drift about the Pole, Mr. Wellman finds that the speed of the wind varies between 6 and 30 miles an hour, with most of the winds at a low speed. He expects to start the trip in a favorable wind, which may last for some days. Even in the case of unfavorable winds, he has most of the chances in his favor. Besides, he expects to stop and anchor the airship during the most unfavorable winds, and make use of the others in general.

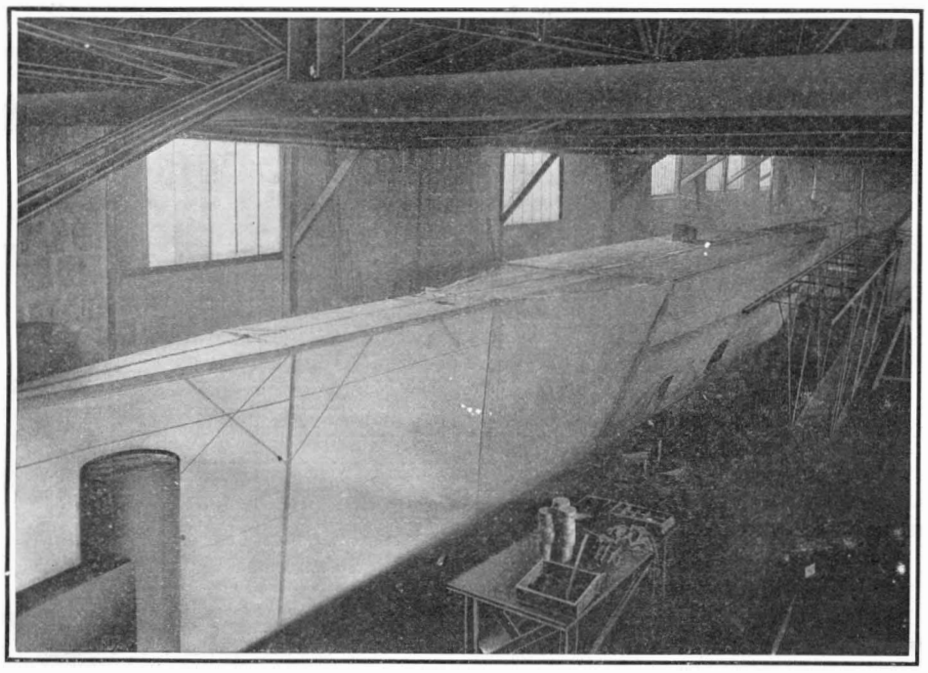
It was decided not to build an airship for high speed, but to use the guide-rope principle. With a guide rope dragging on the ice, the airship will be kept at about a constant height, and besides, the use of this principle affords some advantages which will be mentioned. In order to have gasoline enough on board to cover the trip to the Pole and return, the needed amount was found to be 1,200 gallons or 7,500 pounds, and with the nacelle, crew, etc., the total weight of the airship is 20,965 pounds. Such a great weight requires a large balloon in order to secure the lifting power.

The present balloon, which is of cigar shape with a pointed front end, is practically the same as was used last year, but it was overhauled at Paris during the winter and the length increased, making the total length no less than 183 feet, while the large diameter is 52.5 feet. It is one of the largest airship envelopes which has been built as yet, and its capacity is 265,490 cubic feet. When filled with nearly pure hydrogen from the gas apparatus, the lifting capacity of the balloon will be nearly ten tons. The envelope alone weighs about two tons, and is composed of three layers of rubber-coated cotton, or else two layers of cotton and two of silk in the middle part where the strain is the heaviest. At the ends there are two layers of rubber-coated cotton.

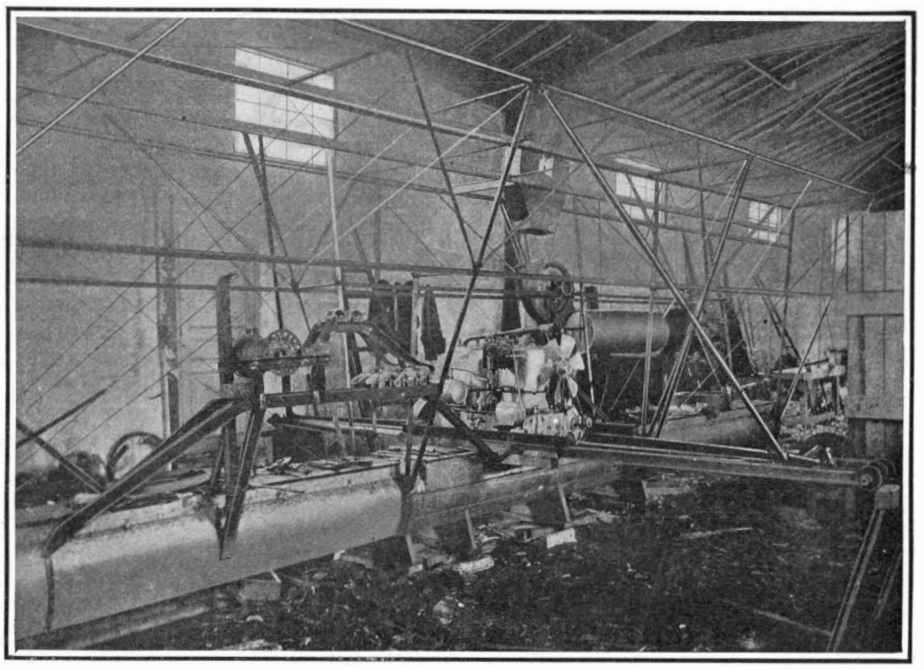
The balloon has been built according to the best experience in this class of work in France, and apart from its great size, it does not show any marked difference from the well-known methods. But when we come to the body framework or nacelle, we find that while in some points it follows what has gone before, it differs from this in most of the features, and owing to its original design, it is of great interest.

Seeing that the form of the balloon was already fixed, the nacelle had to be designed accordingly, and it was found preferable to give it a long and narrow form and suspend it directly below the balloon and quite close it, departing from the design which was used before and also from the Lebaudy pattern, which consists of a nacelle suspended from a flat framework forming the bottom of the balloon. In the present case the nacelle is hung by steel wires from the balloon itself, and in this way a much more even distribution of the load is obtained. One who should have the opportunity of examining it in all its details, as the writer had occasion to do, would be impressed with the engineering skill which Mr. Vaniman has shown in its design and construction. Taken as a whole it is a fine piece of work. It is built of light and strong steel tubes and braced by steel wires. What is the most original feature of the nacelle is the fact that the gasoline reservoir itself forms an integral part of the design of the framework. Because a tank containing 1,200 gallons of gasoline had to be carried, it occurred to Mr. Vaniman that the metal used for the tank might be incorporated into the frame of the nacelle itself. This was done by making a long cylindrical steel tank 18 inches in diameter and of the same length as the nacelle. This forms the under part or keel, and owing to its tubular form, it has great strength. The section of the nacelle is triangular, using two steel tubes attached to the keel and spreading upward in V-shape, joined across at the top by a like tube 3 feet in length. A number of such triangles are placed at intervals throughout the whole length of the nacelle. The corners are joined by long angle-iron beams, the whole being braced by steel wires. At a point near the front a second set of triangular pieces, but having a much wider angle, gives an enlarged part which contains the motor and other apparatus, also lodgings for the crew and the drums for the guide ropes.

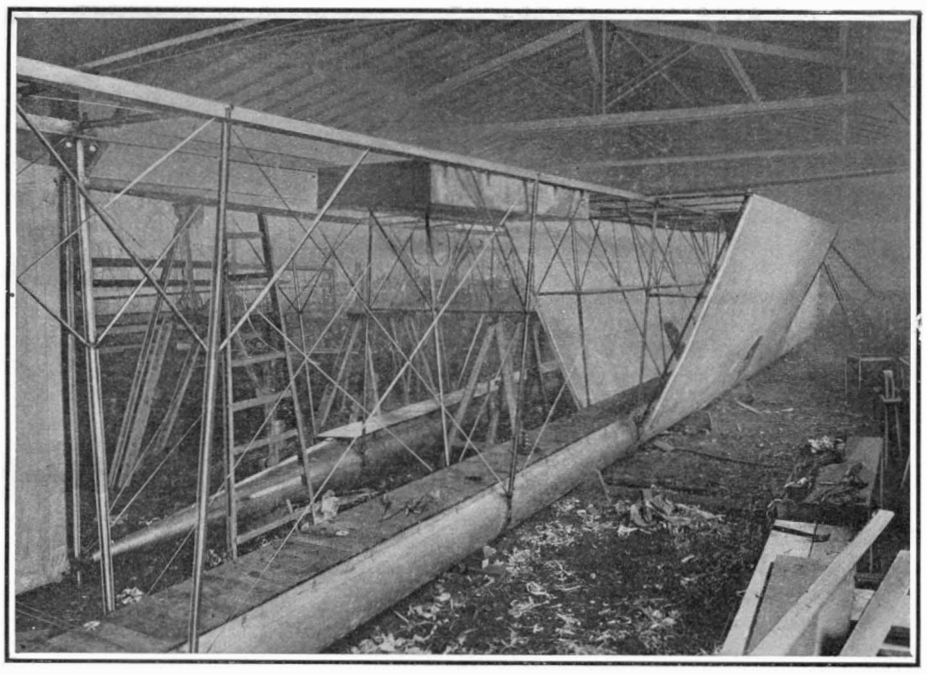
Leading along the top of the keel is a narrow plat-



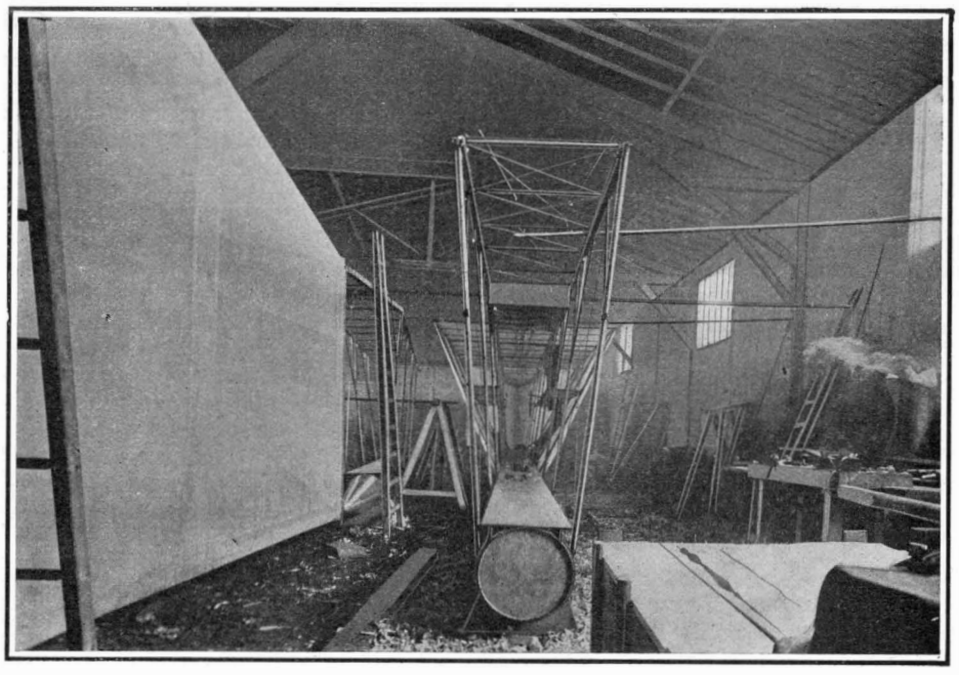
The Nacelle is Entirely Covered with Fire-proof and Water-proof Silk Canvas.



A 60-70 H. P. Lorraine-Dietrich Motor is Used. The Shaft Runs Across the Nacelle and Drives the Propeller Shaft by Bevel Gears.



The Nacelle is Built of Light and Strong Steel Tubes and is Braced by Steel Wires.



Fuel is Stored in a Long Tubular Tank Running the Entire Length of the Nacelle and Forming Part of It.

THE WELLMAN POLAR AIRSHIP EXPEDITION.

form which runs for nearly the whole length of the nacelle, and as the inner height is over six feet, one can walk the whole distance quite easily. The nacelle is entirely covered over with a special waterproof and fireproof silk canvas, which serves to diminish the air resistance as well as to give a comfortable housing for the crew.

Although lying very near the balloon, there will be practically no danger from fire. As the balloon keeps a practically constant altitude above ground, there can be no accident like that which happened to Severo. His airship took fire, no doubt, from the fact that he rose quite suddenly to a great height, which caused the gas to be forced out owing to the expansion, and also be drawn down onto the motor. Here the case is quite different, and there can be no such leak of gas, and what little may leak out (this is shown by tests to be very small) will be taken away from the nacelle as the airship runs through the air. Besides, the nacelle is not only quite covered, but an air-fan is constantly sending air out of the interior so that no gas can enter from the top, and the canvas covering is itself quite fireproof. As some doubt has been expressed upon this point, we may say that any one having the slightest knowledge of actual airship practice will see at once that there can be no danger from this cause under the present conditions. As to the motor itself taking fire, this would happen as often as in a motor car, that is, practically never.

Very ingenious methods are used for the hot air supply. Air is drawn in by a motor-driven fan, first through the radiator of the motor and then through a specially-designed muffling box. The hot exhaust from the motor escapes into a cylindrical box which has a set of tubes, like those of a tubular boiler. When air is drawn past the tubes it is heated considerably. This hot air can be used to warm the quarters of the crew and keep them at a comfortable temperature, and also for filling the two ballonets of the main balloon. By an appropriate device of fan and flues, the hot air can be forced by the blower into one ballonet and the cold air can be drawn out of the second ballonet at the same time. The ballonets have 500 cubic yards capacity each. This causes the balloon as a whole to be somewhat warmed, and even a few degrees above the freezing point will be enough to melt off all snow or sleet. Rain is taken care of by the outer rubber covering. The dimensions of the nacelle are: Length, 115 feet; height, 8 feet; and width at the top, 3 feet. All included, except the guide ropes, the weight of the nacelle is 15,360 pounds, while the weight of the balloon body is 4,190 pounds, making a total of 19,550 pounds. The guide rope, or serpent, lying on the ice, weighs about 1,415 pounds. The motor is of the 60 to 70-horse-power Lorraine-Dietrich four-cylinder type, and was chosen on account of its reliable qualities, this being one of the best motors made on the Continent. Its shaft runs crosswise through the nacelle and is supported to two bracket pieces running outside, as will be noticed. There is a propeller on each side of the nacelle, and the propeller shafts are driven from the motor shaft by bevel gears. With a motor speed of 1,000 revolutions per minute, a propeller speed of 380 revolutions per minute is obtained. It was not found best to use a specially light-weight motor, as this type consumes much more fuel, and with the gasoline on board, the heavier motor will go the farthest distance. As to the propellers, they are of all-steel construction, 11½ feet in diameter. In dynamometer tests they have shown a thrust of some 600 to 650 pounds. It is expected to secure at least a speed of 15 miles an hour, which is all that is desired. A small 5-horse-power motor is used to run the air fan, and there is also a special friction clutch for connecting the propellers to the motor. In the rear of the nacelle is the main rudder, which has 27 square feet of surface. There will be two horizontal planes of small size added to prevent pitching when at anchor.

About four or five hundred feet above ground is the height at which the airship will be kept by means of the guide ropes. Inasmuch as these would have to run over ice or in water, a steel cable would not answer very well, so that a special form of guide rope was designed by Mr. Vaniman which is quite ingenious. It is made of a waterproof leather tube six inches in diameter and 130 feet long, covered on the outside with steel scales like a snake and holding a great weight of provisions, so as to carry no useless material. It can glide easily over the ice and will also float in the water. In general, they will travel with part of the guide rope on the ice, and run at as high a speed as possible. Should the balloon suddenly strike cold air, and drop too quickly, the guide rope falls on the ice for a greater length and lightens up the balloon, thus giving an automatic balance, and the airship cannot vary too much in height. A second guide rope, known as the "retarder," can be used to hold the airship at anchor. This is like the first one, but is provided with sharp hook teeth which catch on the ice. There will be some slip on the ice, however, so as to avoid jerking. Each guide rope weighs 1,300 pounds, of which 80 per cent is in the shape of provisions. Special winches suspend the guide ropes by steel cables.

Among other features which can only be mentioned, are the balancing counterweight which runs upon rollers along the top rails of the nacelle, and is loaded with 600 pounds of provisions; also the bunkers for the crew, who will be comfortably lodged during the trip. Should they be obliged to stay in the Arctic regions to wait for a return the following summer, they have provisions for many months on board. An original feature is that of burning the hydrogen of the balloon in the motor, instead of letting it escape by the valve, as usual. Mr. Vaniman has shown that this can be done easily, of course with all the needed precautions to insure safety.

The party is to be made up of four persons, comprising Mr. Wellman, chief of the expedition; Major Henry B. Hersey, the well-known government meteorologist connected with the United States Weather Bureau; Mr. Melvin Vaniman, chief engineer of the expedition, and a fourth person who has not as yet been selected.

DOUBLE-DECK STREETS AS A RELIEF FOR TRAFFIC CONGESTION.

There is no city in the world in which the volume of travel is increasing so rapidly as in New York; nor is there any leading city where the natural configuration of the site upon which it is built is more unfavorable to the rapid inflow and outflow of the multitudes which gather for the daily transaction of business. In respect of traction facilities, the best location for a city is one in which there are no natural features, such as rivers, seas, lakes, or lofty mountains, in the vicinity of the city to hinder the construction of highways and railroads. The ideal condition is that of a city built in an open plain, with railways and trolley lines radiating in every direction from its business center; and this for the reason that in the case of each line the area served will increase as the square of the distance from the center. But if a city be located by the sea, or upon the shores of some lake, so that the radiating lines of travel are confined, say, to a sweep of 180 degrees, each railway will have to carry its passengers twice as far to secure the same amount of residence area per passenger as it would in the first-mentioned case, in which the railways were free to radiate in every direction from the business center.

The transportation and traffic problem in New York city is rendered specially difficult by the fact that the business district lies mainly at one end of a long and narrow island, and that the majority of the morning and evening travel is confined to certain parallel lines running in a north and south direction. As the tide of morning travel sets in toward the downtown business district, it gathers volume and density as it goes; but during the six to ten miles which have to be traversed down the length of Manhattan Island, although the density of the traffic increases with every mile that is traversed, at least in the earlier stages of the journey, there is no increase in the number of lines of traffic available. Similarly, when the city disgorges its busy workers at night, they are unable to scatter at once to the four quarters of the compass; but must, perforce, the majority of them, move northward for several miles along certain restricted avenues before they begin to scatter.

But the configuration of Manhattan Island, its restricted area, and the high price of real estate, affect the traffic problem unfavorably in another respect, namely, that these conditions have brought about a great increase in the number of exceedingly tall office buildings. This, of course, conduces to the density of population, as will be seen from the fact that, wherever a twenty-story office building takes the place of an old building of five stories, the number of people per unit of ground area is at once quadrupled. If any former resident of New York were to take a walk down Broadway after an absence, say, of fifteen or twenty years, a single glance at its almost endless line of buildings, from twelve to twenty stories in height, would satisfy him that the population of busy workers abutting immediately on this great thoroughfare is at least three times as great as it was at his last visit.

But while the modern city, especially in lower New York, provides accommodations for two or three times as many people as formerly, it seems never to have occurred to anybody that no extra provision is being made to accommodate this added population when it is disgorged into the various thoroughfares. Moreover, with the great increase in the size and number of the business houses, there is necessarily a proportionate increase in the vehicular traffic, both in the number of heavy trucks, drays, delivery wagons, etc., and in the number of public conveyances and private carriages, whether horse-drawn or gas-propelled. Like causes have produced like results, and the congestion on the Subway, the Elevated Road, and the street-car lines is fully equaled, in its resulting delays and inconveniences, by the congestion in the streets themselves. Indeed, had it not been for the good work done in recent years by the Traffic Squad, it is safe to say that by this time some of our leading thoroughfares would have become at certain hours of the day practically impassable. Even as it is, there are sections of Fifth Avenue and Broadway, such, for instance, as the intersection of Forty-second Street with these two thoroughfares, and the crossing of Broadway by Canal Street and Chambers Street, where, despite the excellent work done by the Traffic Squad, the congestion of traffic has become very serious indeed.

There is no question that the chief hindrance to the easy flow of traffic is the presence on our leading thoroughfares of slow-moving trucks and drays, which not only keep down the average speed both of the street cars and lighter vehicles, but provide a most serious obstruction wherever they stop to unload at the sidewalks. The removal of heavy trucking from the streets would do more to expedite traffic than any other change that could be made; and the most effective way to make this change would be to double-deck the streets, reserving the upper surface for the street cars, light vehicles, and pedestrian traffic, and relegating the heavy trucking to a subway built immediately below street level. This arrangement would have the added advantage that freight could be delivered direct to the basement of the business houses, where, in any case, it has to be stored, even when delivered from the street level. There would be a distinct gain in the fact that a large amount of handling and elevator service would be eliminated, while the sidewalks would be rid of the intolerable nuisance which is now occasioned by unloading and transferring freight at the street level.

On the front page of the present issue is shown the constructive details of a plan by which the above suggestion of a trucking subway could be carried out. Immediately below street level is the proposed subway, and below that a standard four-track subway for the Rapid Transit trains flanked by a couple of pipe galleries. The whole of this construction is built of armored concrete. The trucking subway is divided by a heavy longitudinal wall running down the center, with wide openings at the cross streets to accommodate the crosstown traffic and enable trucks to pass from one side of the subway to the other. At the sidewalk line, the roof is supported on lines of heavy columns, an arrangement which permits the trucks to back directly up to the basements of the buildings. At the cross streets access is gained to street level by means of easy inclines, which, in every case, occupy only the right-hand half of the street looking in the direction of travel. At intervals, on the more important crosstown streets, the trucking subway could be extended for one or more blocks to the east or west. It would be a hard-and-fast rule in this subway that all moving trucks must keep to the right hand, traffic on the inclines leading to and from the subway always being in one direction. The construction of trucking subways beneath our most crowded thoroughfares would immediately loosen the street traffic, and greatly reduce its present inconvenience and danger. The schedule of the surface cars could be greatly improved; it would be possible to make a rapid journey up and down town in carriage or automobile; and the gain from a sanitary standpoint would be enormous.

The Current Supplement.

The current SUPPLEMENT, No. 1642, contains a number of articles of a practical nature. Godfrey M. S. Tait records recent progress made in producer-gas installations. A paper by M. C. del Proposto describes an electrical method of power transmission, developed by the author in connection with the use of irreversible internal-combustion engines for the propulsion of ships. George P. Hutchins writes instructively on the storage battery and battery plates. Some novel house-moving operations are described by Edward H. Crussell. There is an element of uncanniness about some of the recent developments in plant growing. The adventurous impulse of the times is leading the modern scientific gardener to experiment in many different ways. He is bringing all sorts of previously unheard-of influences to bear (electric force, electric light, colored lights, germ inoculation, anesthetics, and what not) in the hope of raising a product superior to anything that has gone before. These experiments are admirably summed up in a popular way by G. Clarke Nuttall. "Our Most Destructive Rodent" is the title of an article which will surely open the eyes of those who do not realize how terrible a pest is the rat. Jacques Boyer tells how soft French cheeses are made. A. D. Hall's excellent paper on artificial fertilizers is continued. This instalment is devoted to nitrogenous manures. The paper by E. F. Lake entitled "How to Build a 5-Horse-power Stationary Gas Engine" is concluded.

A French statistician estimates that about 550,000 motor cars have been manufactured in the nine years since the experiments of self-propelled road vehicles first succeeded.

Correspondence.

Artificial Copper—A Denial from Prof. Remsen.

To the Editor of the SCIENTIFIC AMERICAN:

Referring to the article entitled "Artificial Copper," which appears on page 470 of your issue of June 8, I beg to say that this is entirely without foundation. I have so stated over and over again in the newspapers, but the correction seems to be less interesting than the original false statement. I disclaim all responsibility for the statement that Sir William Ramsay has discovered a method of making artificial copper. I hope you will give this correction as prominent a place as you gave to the article referred to. IRA REMSEN.

Johns Hopkins University, Baltimore, Md.

A Word Against Burial at Sea.

To the Editor of the SCIENTIFIC AMERICAN:

Will you be so kind as to explain why it is in this enlightened age that people who die on board our best Atlantic liners have got to be buried in the sea? I can understand why it should have been done forty or fifty years ago, but why it should be continued with all the conveniences the modern steamships have for caring for bodies, is a great mystery to me. If one of the leading steamship companies would advertise that they had abolished the "old-time custom" of burying their patrons at sea, it would make them very popular and force others to do likewise.

Waterloo, Iowa. CORTLANDT FIELD FOWLER.

Railroad Curve Mechanics.

To the Editor of the SCIENTIFIC AMERICAN:

I have read with great interest the able article which appeared in your issue of March 2 on the dangers incurred by high-speed trains at curves. The conclusion reached by your discussion is that "special attention" must be given to the question of maintaining curves at their proper alinement and elevation. However, it seems to me that other factors enter into the problem which were not touched upon in your article.

A bicyclist on rounding a curve will incline his body toward the center of the curve, not when he *starts* to make the turn, but a moment or two *before;* for if he did not thus anticipate the centrifugal action he would be thrown from his wheel. Such an anticipatory inclination is just as necessary for a railway train as for the bicycle rider. It takes a moment or two to shift the center of gravity, whereas the centrifugal force being already existent in the frame makes itself evident on the very instant the curve is entered. It should be borne in mind that a car or locomotive is not a rigid body in which the lifting of the trucks at one side will instantly careen the entire structure; but that the car body is in a measure independent of the trucks, and hence, owing to its inertia or the centrifugal force which resists displacement in the vertical plane, it will respond comparatively slowly to tilting of the trucks. At such a time moments count, for a mile-a-minute train travels 88 feet every second. On this account the track should be banked not only at the curve, but for some distance before the curve is reached. Otherwise the train will be well on to the curve before the center of gravity can be shifted sufficiently to prevent an accident. But to this are opposed the general principles governing railroad construction which tend to maintain unalterable the level of the tracks.

There is another factor, and in my opinion the main factor, of danger which must sooner or later receive the attention it deserves. This is the old question of rigidly securing opposite wheels of a car or locomotive to a common axle. The inner rail of a curve is shorter than the outer rail, and yet these opposite wheels must travel over these unequal distances at the same speed and in the same time. Of course, one of the wheels must slip, grinding away the tread surface of the rail and the wheel. This effect, though well known, has been ignored on the ground of economy, although it would not cost much more to mount the wheels independently. But the fact which must not be ignored is that with the wheels thus coupled together the axles will not keep the ideal radial position and the grinding wheel flanges are thus liable to climb up on to the rail. As long as opposite wheels are rigidly coupled together, it will be impossible for the wheels of a car or locomotive to mold themselves to the curves, hence there will be friction at curves, and as long as there is any amount of friction between the wheels and the rails there will be danger of derailment. E. MUJICA CANTO.

New York, May 7, 1907.

[The gradual elevation of the outer rails preceding the curve is already carried out on railroads. The elevation commences from 125 to 175 feet from the point of curve and rises gradually to the full curve elevation.—ED.]

Do not wrap paper around an incandescent electric lamp for a shade. A fire may easily be started from the heat.

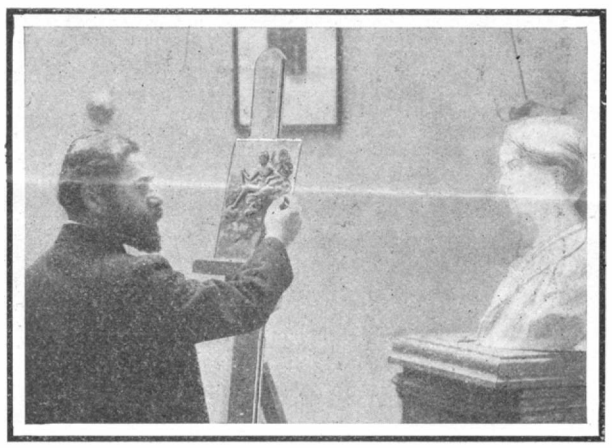
THE ART AND CRAFT OF THE MEDALIST.

BY VICTOR D. BRENNER.

TO trace the origin of engraving, we might refer to our forefathers who dwelt in caves and taught their young the dangerous habits of certain animals, by scratching such images on their walls.

As civilization advanced and intercourse between the families was established, ornaments found their way in their daily lives for personal adornment, and as a token of friendship. Probably the earliest example of engraving upon a portable stone purely decorative may be seen in one exhibited in the British Museum. It is a peculiar kind of pink-veined marble, egg shape, about 2½ inches long, drilled from base to apex with a wide hole, evidently intended for mounting, as the head of a staff of office. The Babylonian inscription on this stone reads "I Sargon the King, King of Agade have dedicated (this) to Samos in Sappira." The date of this document is thought to be 3800 B. C.

The introduction of metal as a medium of exchange in the seventh century B. C. is known to have originated with Pheidon, of the Island of Aegina, and in Lydia at the same period, when each piece of metal was melted separately and weighed to contain the desired value. Some of the early coins were bean-shape or oval. They had the guaranty of the government and an indication of their value on one side, and on the other side four square or triangular holes. These four holes had no significance other than showing the projections of the iron upon which the piece of metal was placed in order to prevent it from slipping while the device was being struck. Later, we find coins bearing a device on both sides, and to strike the metal



Modeling on the Enlarged Bas-Relief.

pieces on both sides necessarily required more complicated tools.

From the models found in ruins—one of which is to be seen in the Paris mint—we learn that in order to bring the two dies in a fixed position facing each other, a long piece of iron was welded to each die, the two pieces of iron being joined together somewhat after the fashion of a pair of tongs. The metal was then placed between dies and the imprint made by the blow of a hammer. The dies seem all to have been cut intaglio or negative, most likely with chisel and hammer, as is done in the carving of marble. The stonecutter's drill, or wheel, as used in the cutting of precious stones, may also have served the die-cutters of that day. Their preparation of the dies for the use of coining must have been substantially similar to our own.

In our own times after the idea is conceived sketches in soft wax are made to determine the desired relief and composition of lines. For the final model, a slate may be used in order to have an even surface; or a surface of wax upon which the design is traced with a point, and bit by bit the wax is applied until the full modeling of the design is obtained. The wax model is made four or five times the diameter of the finished medal.

In many cases the artist will oil the surface of his wax model, and make a mold of it in plaster of Paris. This mold is in turn filled with plaster of Paris and a positive or cameo is obtained representing the model. In other cases, after the wax model has been completed, the artist proceeds at once to translate his design into a block of soft steel, called a die or punch. In the process of cutting, the left hand holds the die firmly in position. In the right hand is held a steel graving tool called a burin, which cuts into the die by the pressure of the palm, guided by the four fingers. The thumb is used as a counterbalance on the die so as to prevent and stop pressure when it has reached the desired depth and length.

An outline sketch is first made freehand on the face of the soft steel by the artist, carefully following the design of the model. Then he commences to cut into the steel with his burin, producing an intaglio which eventually will be the die from which the medal is struck.

After almost every cut of the tool, the artist takes wax impressions of his die to see how the work is progressing and to note how it agrees with the original wax model.

A trained engraver's hand will in time develop an accuracy of touch that will save him many verifications by wax impressions. In leading his graver he can feel the direction of the cut or curve of line, no matter in what depth it may be. The above described process of cutting does not vary in the cutting of a cameo or punch, except that in cameo cutting the work is in relief and the whole design is visible during the entire operation.

Some hundred years before the introduction of the screw press as applied to the striking of coins and medals—an invention of the latter part of the sixteenth century—rollers were used which were engraved with the desired design, and fixed one upon the other, through which a strip of metal was run, thus obtaining as many impressions as the length of the metal permitted. The surplus metal was then cut away with shears or saw.

The most important improvements the screw press brought with it were a ring to encircle both dies, and the cutting of disks alike in size and of uniform thickness by means of a positive punch which fitted into a negative. These disks are cut a little smaller than the actual design, placed between the dies, which are held together by the ring, and pressed. By using the ring to hold the dies together, the disk, being pressed, spreads and fully fills the ring, and thus a uniform appearance and thickness of all impressions is obtained, which facilitates the placing of them one upon the other; and nowadays the piling of one upon the other is of great advantage in counting.

A cameo die, or so-called punch, can be sunk in a soft block of steel. This sinking of the positive into the negative saves much of the work that was necessary before in cutting of a new die—in case of one being broken. With a positive punch several dies can be prepared, in case of emergency. A die may also wear out by constant usage.

In the latter part of the nineteenth century, the manner of sinking the positive into the negative die was changed somewhat. Instead of using punches of small dimensions for hand use, and later larger punches, bearing the entire emblem which was to make the center of the coin or medal (and sunk by means of the press into the negative die, that afterward needed the cutting by hand of the border and lettering), positive punches bearing the complete design of the coin or medal are now in use. This latter improvement of sinking the positive punches with the complete design of the coin or medal is due to Chapu and Ponscarme. With the reducing machine that was invented some thirty years before their time, the engraver is enabled to finish his models in such a manner that they can be used either for casting or for a die. Merely leaving off the polished background in the die, which was in practice for about two centuries, it is possible to give to the medal a finish similar to that made by casting.

Since the introduction of the reducing machine the medalist has his model cast in bronze or iron, adjusts it to the machine and obtains a reduction in steel in any size desired. The reducing machine, which is a kind of pantagraph, was invented by the Frenchman Contamin early in the nineteenth century. A steel point following the model in its reliefs and cavities, transmits by means of a bar its movements to another point which cuts into the steel. This machine saves the artist much of the tedious work required in the cutting of dies by hand. It copies a model with but slight modifications in certain places, and if due allowance has been made in the model, will need but little retouching in the die.

The striking of a medal is entirely mechanical, and is obtained by either hydraulic pressure, or the screw press. The metal disk is placed between the dies, and pressed until the full image is obtained. According to the height of the relief, it may require from one to ten or even more pressures, and annealing the metal disk each time after it has received a blow is a necessary operation.

The medal is now ready to be colored, or as it is termed, have a patina produced on it, for it must be remembered that when a medal comes from the press, it is as bright as a new penny. The patina may be obtained by burnt sienna, by liver of sulphur, or sal-ammoniac, as the case may be, for the bronze. For silver, any oxide will do to give a dark background, and to relieve the surfaces, pumice stone is used with effect.

The popularity of the medal took its origin at the time of Vittore Pisano, of Verona, who was active as a medalist from 1439 to 1449, and who originally was a painter of reputation. We find that the Romans used

metal disks bearing a portrait or allegory of some kind, of a larger size than the coins in use as a medium of exchange. These large disks were used as passes to the theater and also as ornaments. Although it is not certain whether the name *medaglio* originated with Pisano, it was he who introduced the cast medal and who made it known by that name. Pisano's ability as a medalist crowned him as the foremost of all. Apart from being the initiator, it was he who first introduced perspective on the medal, and that feeling of color so much sought after by the medalist of to-day. Attracted by his success, a great demand arose for portraits and allegories made permanent in the medal, and a large number of sculptors and painters devoted themselves to the modeling of medals. Not only did Pisano find followers in his own country, but we find that Germany and France sent their men of ability to study the medal in the place of its origin.

The process followed in the making of a cast medal differs but little at the present time from the earlier methods. It is first modeled in wax; plaster of Paris molds are taken from the wax medal, from which several positive plaster casts can be made, and again formed in sand or a preparation of some kind which constitutes the mold to receive the metal.

The medal differs from any other form of sculpture in low relief in that it must be independent of its surroundings, it must be complete in itself. Standing between sculpture and painting, it may possess all the qualities of a work of art in any of these other media; in miniature conveying a story, suggesting form, color, distance, and space, thus permitting us to enjoy, compressed in its two or three inches, a result which expressed in a work of sculpture or a painter's canvas requires much more room.

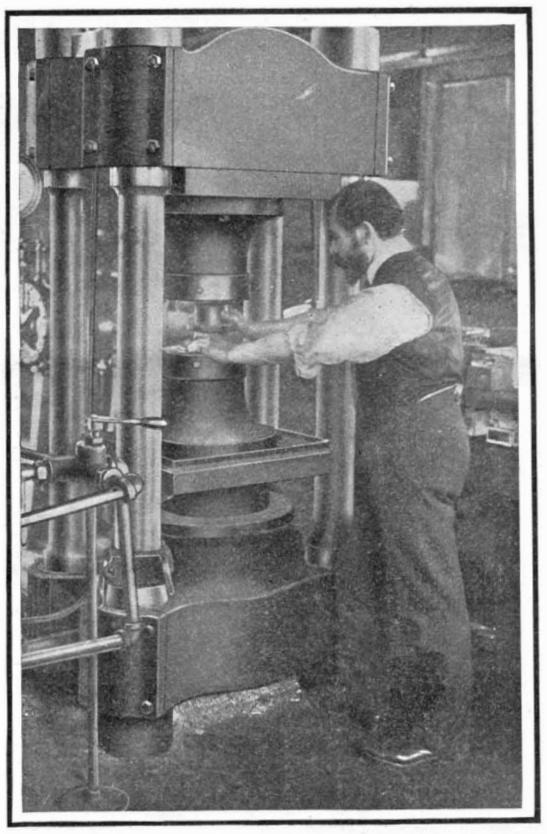
The Greeks, ever sensitive to the beautiful in all its forms, took pains to exhibit in their coinage the best expression of their art. The Romans, too, were heedful of the artistic in their coins. The Italians, closely followed by the Germans and the French, early in the fifteenth century struck souvenir medals to commemorate events of common interest, and to be given out at festivals. Princes and rich men of the Renaissance, as well as rulers of the state, had their portraits placed on the obverse of medals, with their coats of arms on the reverse, thus commemorating their names to future generations.

In Austria a school was opened for the education of medalists, by Maria Theresa in 1768. In 1803 a like school was instituted by the French government in Paris.

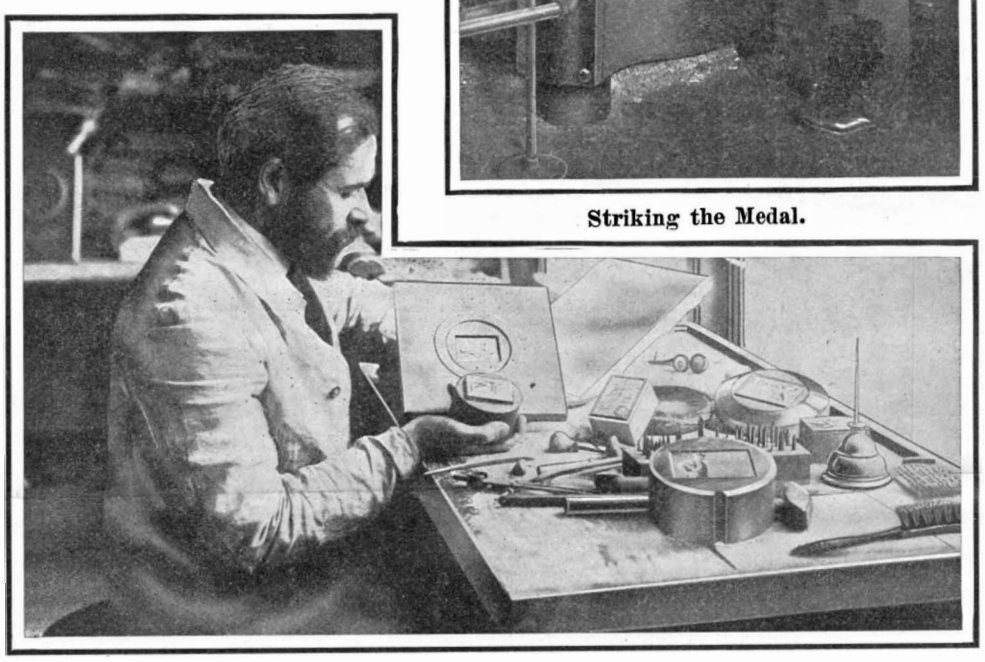
The Paris mint now strikes medals from almost all the dies in her cabinets and even buys from artists new medals, independent of the subject, and strikes medals or plaques from them to sell at cost as a means of education to the general public as well as those who may be specially interested in the subject.

The so-called modern Renaissance of the medallic art had birth in France about fifty years ago. Those most active therein have been David, Chaplain, Oscar Roty, Alexandre Charpentier, of Paris; Anton Sharff, Powlick, Marschall, of Vienna. With them the medal assumed a wider scope even than it had known before, in that it was not only made to commemorate an event, or memorialize a person, but was made also the means of the artistic expression of the thought and fancy of the artist.

Relief Punch and Intaglio Die.



Striking the Medal.



The Medalist's Engraving Bench, Showing Die in Collar.

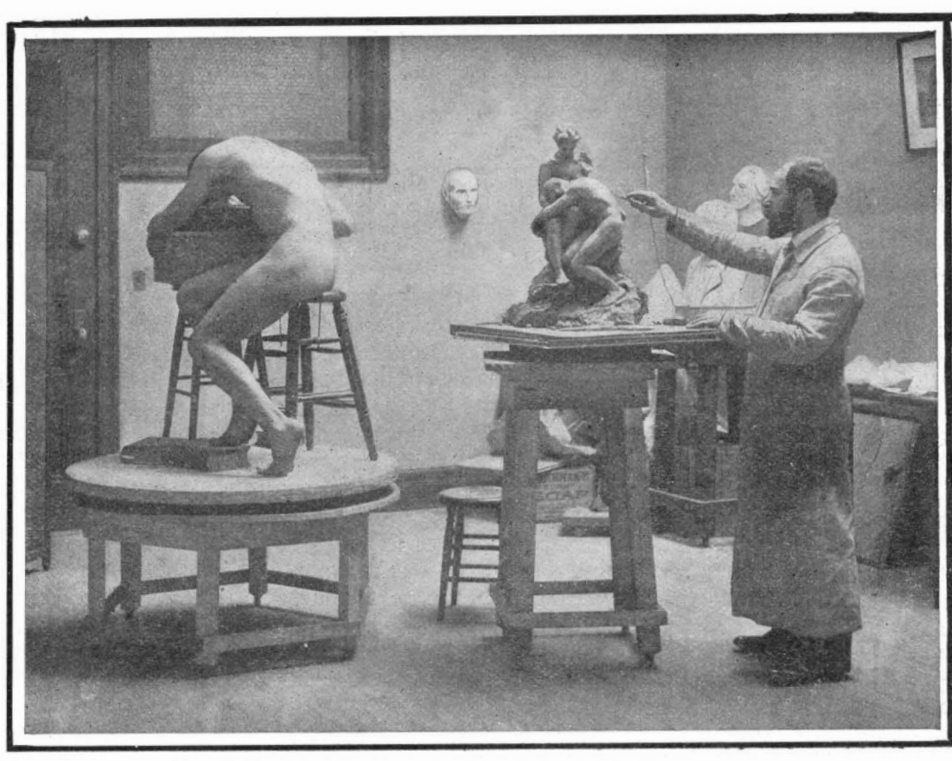
A New Process of Producing Iron.

In a lecture recently delivered at Christiania, Mr. A. Hiorth suggests a novel process of producing iron from Norwegian ore by the aid of Norwegian materials. Norway at present exports large amounts of iron ore, which is refined abroad, while the wants of the country are supplied from the import of goods manufactured from its own ores. Now, the extensive ore deposits, in connection with the plentiful waterfalls of the country, might be utilized to advantage by means of an electro-metallurgical process; and in order to be independent of other countries also in regard to the carbon used in reducing iron ores, Mr. Hiorth suggests the utilization of the extensive graphite layers which are found in many parts of Norway. This would be the more advantageous, as the graphite in question is not pure enough to be used as a material for manufacturing crucibles, pencils, and the like.

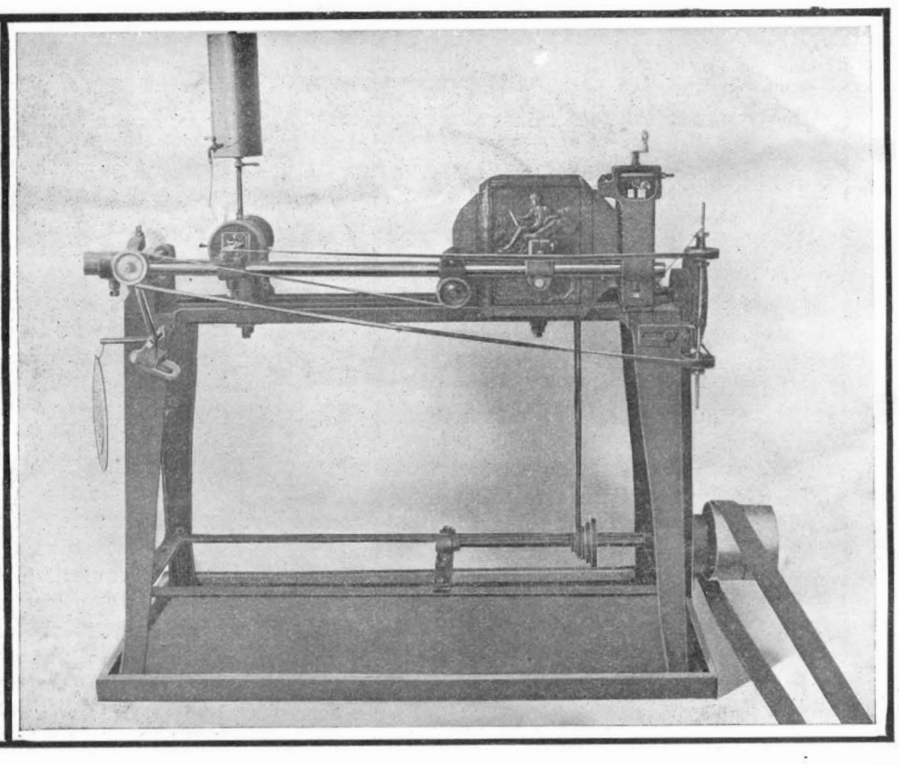
Graphite is the heaviest and purest carbon found in nature, and is extremely stable in regard to chemical reactions. It is unable to burn like coal. However, Mr. Hiorth some time ago suggested producing carbide by smelting graphite with lime, apparently with a low consumption of energy. Whereas the carbon otherwise used in the manufacture of carbide has first to be converted to graphite, the immediate use of graphite obviously warrants a saving of energy.

In view of the satisfactory results obtained in this connection, the author was led to using it as reduction agent. It may be said that about one ton of coal is used in the blast furnace for each ton of iron, while in the electrical furnace the maximum amount of coal corresponding to the same quantity of iron is one-third, the melting heat being supplied by electricity. The cost of carbon is reduced to about one-ninth as against the blast furnace process by using graphite in the electric furnace. The author feels confident in assuming that this process would allow iron to be manufactured on a satisfactory basis, his recent laboratory experiments having shown graphite to be an excellent agent of reduction for iron ore. In fact, fine pig iron can be obtained in the electric furnace even from very low-grade ores and graphite holding upward of thirty per cent of silicates and silica.

The iron thus obtained from practically valueless carbon and iron ore, which otherwise would be quite unfit, is practically free from any impurities of the raw material, these constituting the slag. Even the latter could be used as excellent building material.



Mr. Brenner Modeling from Life.



The Reducing Machine Which Makes the Relief Punch from Which the Intaglio Die is Struck.

THE ART AND CRAFT OF THE MEDALIST.

MECHANICAL MASTERPIECES OF THE EIGHTEENTH CENTURY.

BY DR. ALFRED GRADENWITZ.

While modern industry compels inventors to guide themselves in their work exclusively on the principle of utility, aiming with the aid of their machines at a saving of time and energy, workmen and engineers of former centuries were allowed sufficient leisure, now and again, to indulge in their imagination, and even to devote a considerable portion of their lifework to designing ingenious and wonderfully intricate mechanisms, that are apt to be looked upon by modern men as mere toys. However, these products of mechanical skill deserve our interest, and not only for curiosity's sake; by such fanciful work their constructors have in fact contributed to a great extent to developing their art, enabling their successors to work sufficiently in the very paths of our present hustling industry.

A striking instance of this assertion is afforded by the work of two Swiss mechanics, Pierre Jaquet-Droz and his son Henri Louis, who in the second half of the eighteenth century laid the foundation of the renowned Swiss watch industry.

This industry, which is at present so highly developed, was at that moment in its earliest stages, and was able only with difficulty to compete with that of the neighboring countries. Methods were in fact rather primitive, nor had the principle of division of work been carried through; the same workman who made the clockworks frequently manufactured and adorned the casings. It was not until the advent of the two Jaquet-Drozes that a revolution was wrought in this state of matters.

Pierre Jaquet-Droz had, as a youth, on account of his remarkable intelligence, been destined by his parents, wealthy farmers at Chaux de Fonds, to be a minister, and was only by chance directed into the career in which he was to become so great a master.

When young Pierre once came home for his holiday his attention was drawn to his sister's work, who according to the fashion of the day had taken up the new industry. Her mechanisms immediately awoke his interest, and what at first had been merely a fancy gradually filled up his thoughts entirely, and induced him to leave theology and devote his life to the construction of watches and other mechanical appliances. He quickly acquired the use of tools, and his first productions already are masterpieces that excite the admiration of his fellow citizens, proving an incomparable inventive genius allied to exceptional manual skill.

It was very fortunate for the young artist that Lord Keith, governor of the country of Neuchâtel (which at that time belonged to Prussia), to whom he was once introduced, should become interested in him, realizing at once his extraordinary gifts. He induced Jaquet-Droz to go to the court of Ferdinand VI. at Madrid, where he met with the most friendly reception. The numerous and most liberally remunerated commands which he there received enabled him in future to work quite freely, and established not only his own fame, but at the same time the renown of the hitherto unheeded watch industry of western Switzerland. After returning to his country, Jaquet-Droz there spent many years of a highly productive life. In his son Henri Louis, the education of whom he from the very beginning guided on his own principles, he found an equally gifted assistant, while Leschot, Maillardet, Jean Pierre Droz, and others, became skilled disciples, who propagated the art of their masters not only in their own little country, but all over the world. Jaquet-Droz, Jr., in conjunction with Maillardet, founded a watch factory at London, and to the joint work of these men we are indebted not only for a large number of masterpieces that are even now admired universally, but also for an unexpected development in the watch industry of French Switzerland.

The Society for the History of the Canton of Neuchâtel has just prepared an interesting exhibition of productions of the two Jaquet-Drozes, and through the courtesy of C. Perregaux, director of the Technicum of Locle, the writer is enabled here to illustrate and describe the most famous.

These are three automatons, which may be said to be the most perfect "artificial men" ever produced by human skill, and which during the lifetime of their authors and after their death until the present moment have been wandering throughout Europe and America, being admired both at the courts of princes and in the homes of poor and rich. They were purchased a short time ago by a Berlin collector, but the canton of Neuchâtel is trying to gain them back, in order to preserve for the country these historical treasures.

The most ancient as regards the time of its production is the "Writer," represented in Fig. 1, a child of about four years of age, who, sitting at his little table, patiently waits with the pen in his hand until the clockwork is started. He then sets to work, and after looking at the sheet of paper before him, lifts his hand and moves it toward the inkstand, in which he dips the pen. The little fellow then throws off an excess of ink and slowly and calmly, like an industrious child, begins writing on the paper the prescribed sentence. His handwriting is careful, conscientiously distinguishing between hair strokes and ground strokes, always observing the proper intervals between letters and words, and generally showing the sober and determined character of the handwriting usual at the time in the country of Neuchâtel. In order, for instance, to write a *t*, the writer begins tracing the letter at the top, and after slightly lifting his hand half-way, swiftly traces the transversal dash, and continues writing the original ground stroke.

How complicated a mechanism is required for insuring these effects will be inferred from Fig. 2, in which the automaton is illustrated with its back opened. In the first place a vertical disk will be noticed having at its circumference as many notches as there are letters and signs. Behind this will be seen whole columns of cam-wheels, each of a special shape, placed one above another, and altogether forming a sort of spinal column for the automaton.

Whenever the little writer is to write a given letter, a pawl is introduced into the corresponding notch of

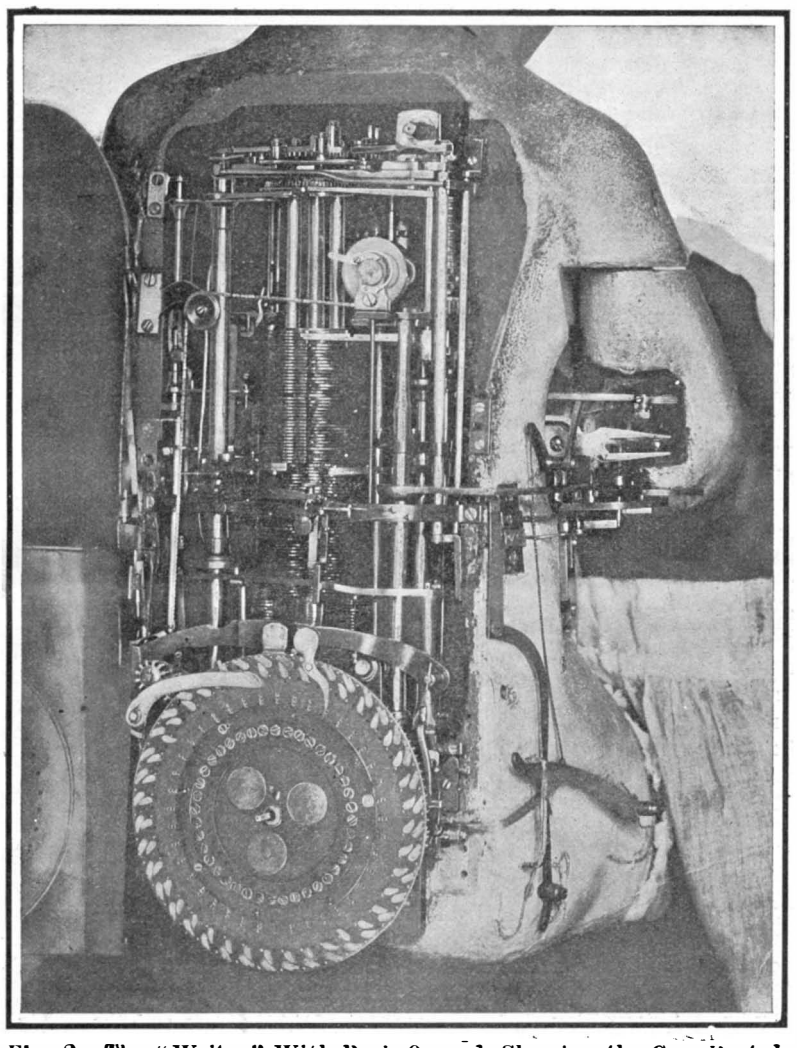


Fig. 2.—The "Writer" With Back Opened, Showing the Complicated Mechanism.

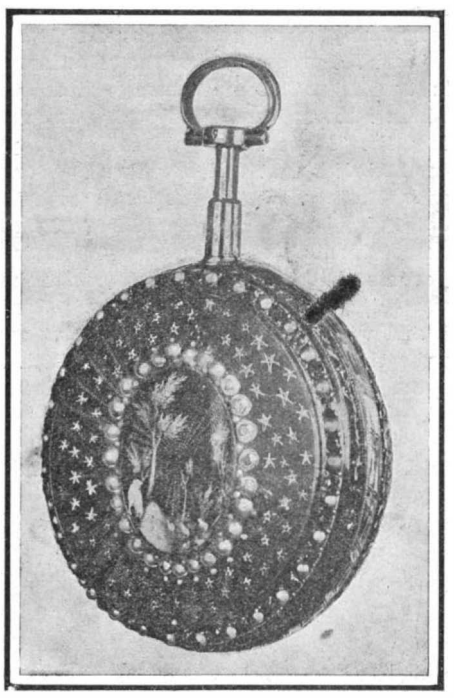


Fig. 7.—Jeweled Watch Made by Jaquet-Droz, Jr.

Fig. 6.—The Spinet Player in Her Original Costume.

Fig. 1.—The "Writer" Automaton.

Fig. 5.—The "Spinet Player" Modernized.

the disk, thus lifting the wheel column and transmitting to the hand, by the aid of a complicated lever system and Cardan joints arranged in the elbow, the requisite movements for tracing the letter in question. The mechanism comprises five centers of motion connected together by chains.

According to tradition, Pierre Jaquet-Droz controlled his automaton from a distance without touching it in any way. By his voice he stopped the little writer in his work, or directed him to write the name of some of those present. To produce this effect he is said to have used a magnet hidden below his clothes. This legend as well as many others which surround the personality of the artist will hardly bear criticism.

Fig. 8.—Portrait and Autograph of Pierre Jaquet-Droz.

In Fig. 3 is reproduced a sample writing from the year 1896 (the automaton then was in the possession of Henri Martin, a Dresden mechanic) and in Fig. 4 a sample from the year 1906, shortly after the little fellow returned to his country.

In the "Draftsman," the mechanism is likewise arranged in the body itself, as in the case of the "Writer." The broad chest thus entailed also required a large head, which accounts for the somewhat bulky appearance of the two automatons. With the paper in position and a pencil in hand, the "Draftsman" at first traces a few dashes and then swiftly marks the shadows, and a dog appears on the paper. The little artist knowingly examines his work, and after blowing away the dust and putting in a few last touches, stops a moment and then quickly signs: "Mon Toutou" (My pet dog). The motions of the automaton are quite natural, and the outlines of his drawing extremely sharp. The automaton when desired willingly draws certain crowned heads now belonging to history; for example, a portrait of Louis XV., of Louis XVI., and of Marie Antoinette. To the latter drawing attaches a little anecdote: Jaquet-Droz, Jr., with the assistance of his friend Leschot, when demonstrating before the Queen of France, the mechanical artist obviously chose as *piece de resistance* the portrait of the Queen herself. Unfortunately, however, Leschot, in handling the automaton, made a mistake, and in the place of Marie Antoinette there appeared on the paper "Mon Toutou." This mistake naturally produced some uneasy feeling in those present.

In Fig. 5 we represent the third automaton, the "Spinet Player," which has the appearance of a girl of about twelve years of age, who by the way has kept pace with fashion, replacing her old spinet with a modern harmonium. Her dress has likewise undergone, in the course of a century and a half on her many migrations, a number of transformations which cannot exactly be said to be to her advantage, as will be inferred from a comparison of Fig. 5 with Fig. 6, in which the piano player is represented in her original appearance, with her becoming costume in the style of Louis XV.

As soon as the player is set working, she bends forward, in order better to see the notes, the regular respiration of her breast being plainly seen. Her fingers swiftly slide over the keys, continuing their lively play if the automaton be lifted off the keyboard. The young lady has five melodies at her disposal, and never fails to close her performance with a graceful bow.

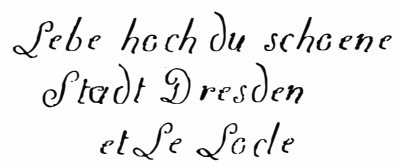


Fig. 3.—Sample of the Writing Done in 1896.

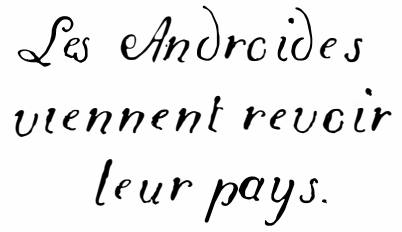


Fig. 4.—Sample of the Writing Done in 1906.

The inventory of Jaquet-Droz, Jr., in 1786 quotes the "Piano Player" for the amount of 4,800 livres and the "Draftsman" for 7,200 livres. The "Writer" was ceded by Jaquet-Droz, Sr., to his son for the sum of 4,800 livres, it being stated that some modifications were made to the mechanism by the latter.

By comparing the present handwriting of the "Writer" and the productions of the "Draftsman" with samples transmitted from former periods, they are seen to have remained unaltered during one and a half centuries; the "Piano Player" likewise still performs the same melodies that delighted her auditors in the eighteenth century. These "artificial men," in the course of their adventurous careers and migrations all over two continents, were witnesses of the violent historical events that took place in the meantime. All these revolutions they have outlasted well-nigh unaltered, and with their antiquated exterior appear to us like the children of bygone ages, of which they, as it were, are bringing us greetings.

Telegraphy Without Batteries.

An interesting telegraph apparatus dispensing with batteries was invented some time ago by a Spanish telegraph official, and has been tested over resistances corresponding to a telegraph line upward of 621 miles in length.

In this apparatus the manual labor of the operator in transmitting Morse signals is employed to generate the currents required for the working of the telegraph circuit. As the currents thus generated by induction are high-tension alternating currents, they readily overcome the resistance of the circuit, traversing considerable distances. The apparatus comprises a lever which is pivoted on a metal support, and which at its rear end carries a soft iron armature in contact with the cores of a pair of high-resistance coils, which are extensions of the poles of a semi-circular magnet.

Sketch of Cupid drawn by a butterfly.

King George III. and Queen Charlotte, as sketched by the draftsman in their presence in 1774.

Fig. 10.—Drawings Made by the Jaquet-Droz Artist Android.

Whenever by the action of this lever (which serves as Morse key) the armature is removed from the cores, a direct current is produced, while a reverse current is generated each time the armature returns to its position of rest. These currents are thrown in the telegraph circuit.

By means of a special contrivance, the resistance of the receiving apparatus is cut out of the total resistance during the transmission of telegrams, while that of the current generator is eliminated during the receiving.

After each current impulse the circuit is discharged by an earth contact. A relay actuated by a single dry cell in the local circuit is used as a receiver. The lever of this relay accurately repeats any motion of the sending key, as does that of the receiving apparatus, by which the Morse signals are recorded with great accuracy. Each direct-current impulse due to the disconnecting of the armature from the cores will result in the relay lever's striking a stop and remaining in contact with the stop until a reverse current returns it back to its position of rest. As in this telegraph scheme, the connection of the line with the receiver is never discontinued, it could as well be designed for a duplex system, and the inventor is engaged in designing an arrangement suitable for this purpose,

Fig. 9.—The Automatons of Jaquet-Droz Exhibited at the Court of Louis XV.—From an Old Lithograph.

MECHANICAL MASTERPIECES OF THE EIGHTEENTH CENTURY.

DO ANIMALS REASON?

BY L. A. CAMACHO.

Reason is that faculty of the mind which argues rationally, and which from known facts draws conclusions. This faculty has been annexed by the King of the Animal Kingdom to his own special domain, and he has obtained a good deal of satisfaction in his supposed exclusive possession of this valuable asset.

Now, when a fellow can't tell you what he is thinking about, either because he has no language, or because you do not understand it if he has, it is rather difficult to fathom the workings of his mind; and we are tempted to say that what we do not understand does not exist. It is fair to say that this applies to our lack of understanding of the minds of animals.

And this brings us to "Dohong," an orang-utan, that occupied a cage in the north end of the Primates House at the Zoological Park in the Bronx. He was a fine, big, red fellow with the long arms of his kind and a very serious manner. Perhaps he never really smiled, but there was a kindly expression about his face which was very attractive. He took life very seriously, was most deliberate in all his actions, and was curious in a most careful and painstaking way.

The walls of the cage in which he was confined are lined with smooth lignolith below and wood above. At the back there is a door through which the cage is entered. This door is set in a partition which does not go to the top of the cage, but only up about five feet, making a shelf about three feet in width; and the back wall of the cage goes from the shelf to the ceiling. On each of the side walls there is a round perch or bar of one and one-half inches diameter, running from the back to the front of the cage; and this bar is supported by wrought-iron brackets bolted to the wall. In the center of the cage is a trapeze hung by chains.

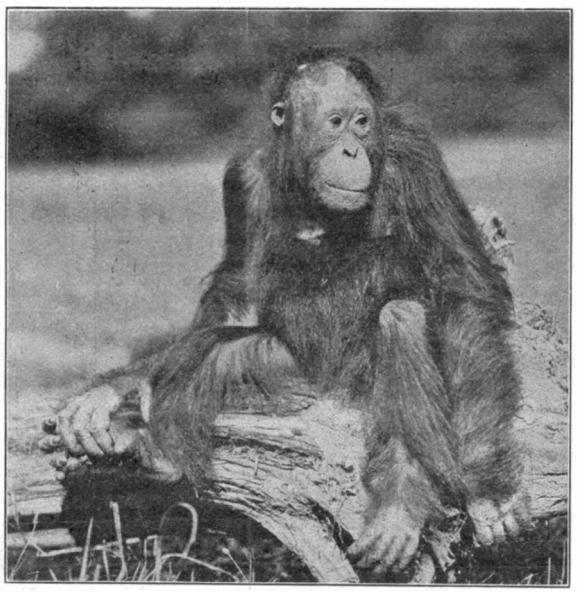
"Dohong" was destructive—not constructive. This was partly due to lack of education, but principally to lack of opportunity. Everything was provided for him. His bed was loose straw, which served his purpose. A blanket might have been better for him, but to tear up a blanket was an admirable way to while away a half hour of the dreadful tedium of cage life. His food came at regular intervals unasked. What more can an ape require than enough to eat and a place to sleep? Strange to say, "Dohong" wanted more. He wanted occupation, and as there was no nest to construct, and no enemies to guard against, he started in to destroy.

Occasionally he had for companions two chimpanzees of the opposite sex, who were fairly ladylike in their behavior, but ever ready to aid and abet "Dohong" in any of his schemes. "Dohong" had no compunction in making use of their services when he required them.

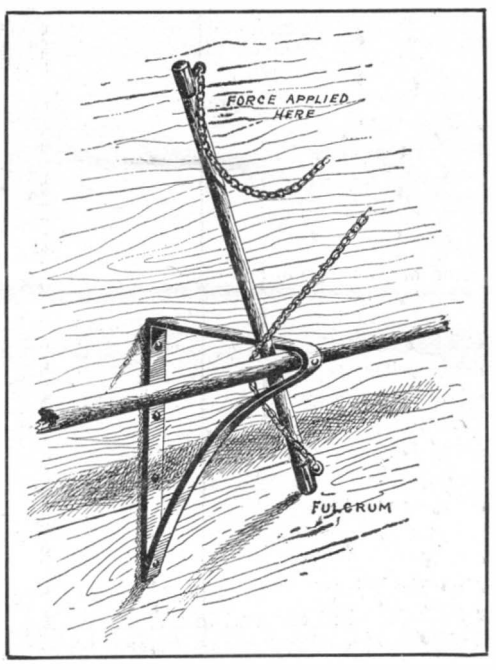
The bars on the side of the cage were to him a source of great interest. How could he get them down? He stood in front of them, looking at them in a most critical manner, and considering the question. He got up on the shelf and took hold of one end, grasped a steam pipe with the other hand, and pulled. No success. He then persuaded one of his friends, the chimpanzee, to assist him; and they worked together. The writer did not see how they loosened the first bracket, but he did see what he did with the second bracket.

This is what he saw: The distance between brackets is about three feet. The first one was loose, and "Dohong" was standing on the shelf pulling at the end; but the second bracket held. He let go, stopped and considered, rubbing his chin with his hand for all the world like a workman who has a difficult piece of work before him. He mounted the bar, put his back against the wall and pushed. Getting no result, he persuaded one of the chimpanzees to help him, she sitting next to him on the bar. No result. The other chimpanzee sat on the floor watching the affair with intense interest. At last, with a mighty effort, they succeeded in breaking off a piece of the bar, and the chimpanzees went off with it in a wild chase. Not so with "Dohong." He had his work to do, and felt the responsibility. Reaching down from the bar, he caught the chains holding the trapeze, thrust the bar of the trapeze through one of the brackets, and by main strength pried the bracket loose.

Let us analyze a little. This ape certainly argued rationally, for in no other way could he have correctly applied the lever. Even admitting that he knew by instinct (whatever that is) what the lever was, to apply a lever correctly one has to use reason. He must have reasoned out what a lever would do, and concluded that in the bracket was the proper place to apply it. It is the case of an animal using a tool. Without question he made use of reason, and any one watching him would have seen that the ape undoubtedly thought the whole matter out in a careful, deliberate, and painstaking way. It will be noted that this writing is in the past tense, for "Dohong" is no more. On a visit to the Zoo some weeks ago his cage was found empty, and an inquiry of one of the keepers brought the reply, "He's gone." It was said with a certain sadness, for, ape though he was, he had a personality, and who will question after this testimony that he had some of that which humans call intellect?



"Dohong," an Orang-utan Who Invented the Lever.



How "Dohong" Applied the Lever.

N. B.—This article was submitted to Dr. Hornaday, Director of the Zoo, for his approval and criticism. Dr. Hornaday states that "Dohong" used a lever on many occasions.

AN ARTIFICIAL RESPIRATOR.

BY JOHN W. HALL.

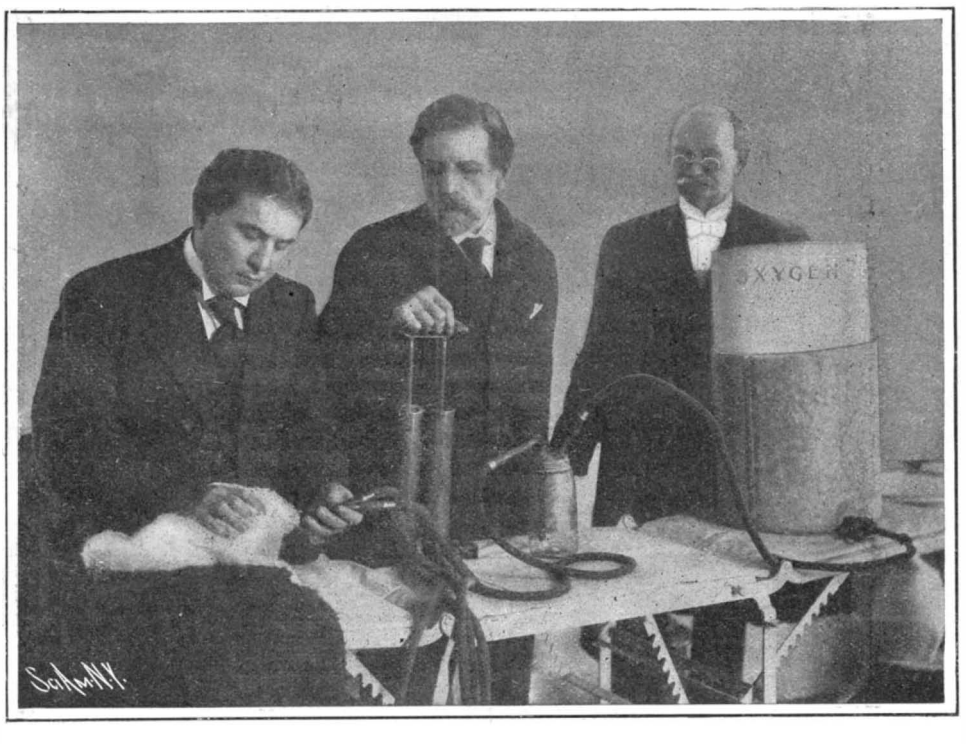
An apparatus for producing artificial respiration has recently been devised whereby in cases of suspended animation the action of the heart and lungs can be renewed. Prof. George Poe, the inventor of the apparatus, does not insist that with its use life can be brought back, but claims that by artificial means applied through the instrumentality of the respirator persons killed by asphyxiation, poison, or drowning can be resuscitated; that the death of persons under the influence of anæsthetics while being operated upon can be prevented; that its use will prevent "infant asphyxia" at birth; that a drunken person can be sobered in a few minutes; that persons electrocuted or hanged—in the latter case where the neck has not been broken—can be revived, and that the freezing to death of Arctic explorers can be obviated. These results are accomplished by simulating normal respiration through artificial means.

Prof. Poe has been long studying the problem as to when life actually leaves the body, and as early as 1876 he began experimenting in pumping oxygen into the lungs of supposedly dead animals with varying success. Interest in his study was accentuated by the fact that he had a young sister who, after lingering with typhoid fever, was pronounced dead by the attending physicians and that she had revived within two hours of the time set for her burial, and lived for many years thereafter.

The machine or apparatus of Prof. Poe is modeled directly after nature and is shown to be practical. He proceeded on the theory that to revive persons drowned, suffocated, or dead through ill-advised use of anæsthetics, the way was to remove the water or the poisonous gases in the lungs, and at the same time supply life-giving oxygen. So he began experiments on what he calls double larynx tubes or two tubes to connect with the nostrils—one as an inlet and the other as an outlet—and, studying the action of the heart, he saw that it was that of a double cylinder, or, rather, two cylinders, right and left ventricles and right and left auricles. He built his machine in line with the construction of the heart—a simple machine with two cylinders, each having an inlet and an outlet valve. The plungers of each cylinder were made to work simultaneously.

A demonstration was made on a rabbit, which is clearly shown in the accompanying illustration. Two grains of morphine were injected into the leg, after which four ounces of ether were administered. It was believed by the experimenters that life was positively extinct, as the application of every known test failed to reveal any sign of life. In this condition, the tubes of the apparatus were applied to the rabbit's nostrils and, on pumping out the poisons with one cylinder and pumping oxygen into the lungs with a simultaneous movement of the valves, within three minutes the rabbit, but lately pronounced dead, was breathing naturally and within six minutes it was running around the room. The ether was entirely out of the system, as there was no indication of nausea.

A dog was placed in an airtight box containing a heavily-charged atmosphere of acetylene gas and smothered for forty minutes. It was pronounced dead beyond the hope of resuscitation. The respirator was set to work and in a few minutes the animal began to breathe naturally and soon its pulse was normal, showing that all poisons had been removed from the system. So far, the artificial respiration apparatus has not been demonstrated on a human subject, but it is believed that the results would be the same as shown on the animal creation.



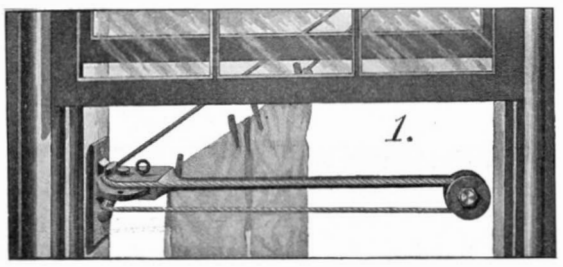
RESUSCITATING A RABBIT WITH THE RESPIRATOR.

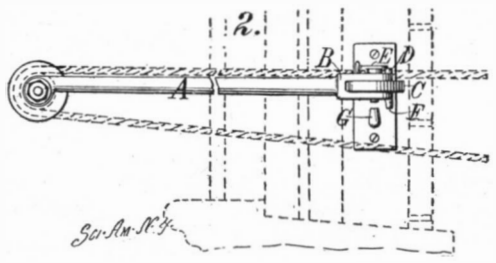
According to a paper recently read before the Zoological Society by Mr. R. I. Pocock, two distinct types of so-called tabby cats are recognizable. In the one the pattern consists of narrow vertical stripes; and in the other of longitudinal or obliquely longitudinal stripes which, on the sides of the body, tend to assume a spiral or sub-circular arrangement characteristic of the blotched tabby. One or other of these types is to be found in cats of almost all breeds, whether Persian, short-haired, or Manx; and there appear to be no intermediate stages between them. Cats of the striped type are no doubt descended from the European and North African wild cats; but the origin of cats exhibiting the blotched pattern appears to be unknown. As it was to a cat of the latter kind that Linnæus gave the name *Felis catus*, the author urges that this title is not available for the European wild cat, which he would call *Felis sylvestris*.

Patent Department

AN IMPROVED CLOTHES LINE HANGER.

A source of great danger to the servant or housewife in our city flats and apartment houses is to be found in the necessity of leaning out of the window to hang the wash on the line. To overcome this danger a number of hangers have recently been invented, which are so arranged that a portion of the line may be brought into the room to facilitate hanging the clothes there-



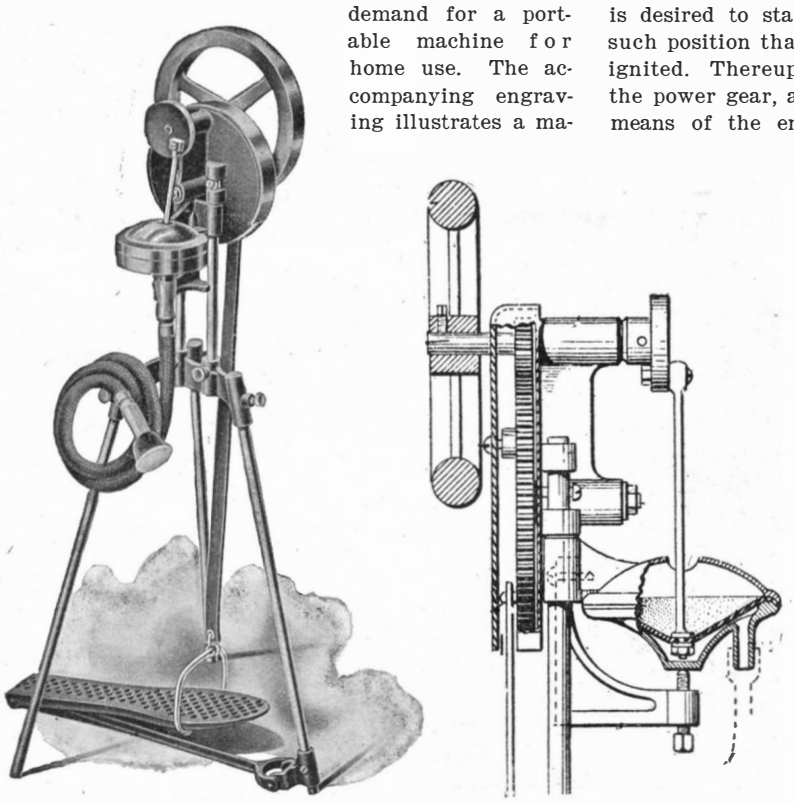


AN IMPROVED CLOTHES LINE HANGER.

on; after this the line may be moved out to permit of closing the window. One of the most recent of these devices has been invented by Mr. Frederick W. Steuer, of Plainfield, N. J. As shown in the accompanying engraving, the device consists of an arm *A*, which at its outer end supports a pulley. The opposite end of the arm is formed with a forked head *D*, which fits over a bracket *C*, and is pivoted thereto. The bracket *C* is in the form of a broad horizontal disk, secured to a baseplate, which is fastened to the frame of the window. On the forked head *B* a lug *D* is formed, and on the baseplate of the bracket is a flange *E*. The upper run of the clothes line passes under this flange and around the pulley. In use the arm *A* is swung into the room, and the clothes are hung on the lower run of the line. This done, the lower run of the line is caught over a hook *G* formed on the baseplate. Then the arm is swung outward across the window as shown in Fig. 1, when the lug *D* will lock the line firmly in the aperture formed beneath the flange *E*, and a lug *F* formed on the under side of the forked head *B* will move into engagement with the hook *G* to hold the lower run in place. The disk *C* of the bracket is formed with a number of apertures adapted to receive a locking pin which passes through the forked head *B*. In this manner the arm may be locked at the desired position.

A NOVEL PNEUMATIC MASSAGE MACHINE.

The phenomenal popularity of massage treatment, especially of the vibratory type, has created a large demand for a portable machine for home use. The accompanying engraving illustrates a machine of this character which possesses considerable novelty, both in its operation and in its effects. A glance at the line drawing, which shows a vertical section through the mechanism, will reveal the character of this machine. It will be noted that it produces pneumatic pulsations by means of a rubber diaphragm, which is vibrated in a cup at one side of the machine, and that these pulsations may be conducted to the part which is to be treated through a flexible tube. The machine is adapted to be operated by foot power, being provided with a treadle connected by a link to a crank wheel. This wheel is formed with gear teeth adapted to engage a pinion secured on the driving shaft. A flywheel is mounted on one end of the driving shaft, and a crank disk on the other end. A pitman connected to the crank disk passes downward into the cup, and is secured to the rubber diaphragm therein. It is evident that when the treadle is operated, the diaphragm will be moved up and down at a rapid rate, alternately rarefying and compressing the air in the cup, and thus producing the pneumatic pulsations. The design of the machine is very simple, the parts being removable, so that the entire apparatus may be folded up into a small space to permit of packing it in a suit case. The height of the apparatus when set up is only 30 inches, and its weight is but 15 pounds. A patent on this novel massage machine has been granted to Mr. Carl Rosen, Pennoyer Sanitarium, Kenosha, Wis.

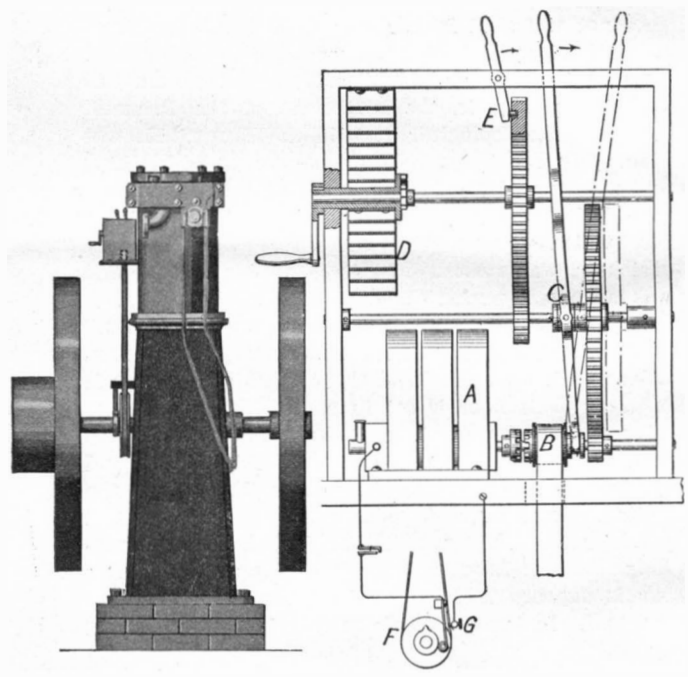


A NOVEL PNEUMATIC MASSAGE MACHINE.

SPARK-PRODUCING MECHANISM FOR EXPLOSION ENGINES

It is the custom in explosion engines which use a magneto to provide an induction coil with which to start the engine until it has attained sufficient speed to properly operate the magneto. In the accompanying engraving we illustrate an improved mechanism, whereby the magneto may be mechanically operated independently of the motor with sufficient speed to produce the requisite spark, thus dispensing with the necessity of using an induction coil. The accompanying illustration shows the mechanism in detail, and also a view of an explosion engine with the spark-producing mechanism applied thereon. The magneto is illustrated at *A*, and the armature shaft is provided with a clutch, whereby it may be connected with a loose pulley which carries the usual driving belt *B*. The lever *C* provides means for throwing the clutch into and out of mesh. Keyed to the armature shaft is a pinion, which is engaged by a large gear wheel splined to a second shaft supported in bearings in the frame of the mechanism. This gear wheel is connected to the lever *C* in such manner that when the latter moves the clutch into mesh, the driving gear is moved out of mesh with its pinion, as shown by dotted lines in the illustration. Keyed to the shaft which supports the gear wheel is a pinion, which engages a second gear secured on the power shaft. A heavy clock spring is fastened at one end to a sleeve on the power shaft, and at the opposite end to the frame of the mechanism. The spring may be wound up by operating a hand crank, which is keyed to the sleeve. The latter is connected to the power shaft by means of a ratchet and pawl. Mounted in the upper end of the frame is a short lever *E*, provided with a lug adapted to engage an aperture in the power gear wheel. In operation, after the spring has been wound up, when it is desired to start the motor the latter is turned to such position that an explosive charge is ready to be ignited. Thereupon the handle *E* is moved to release the power gear, and the mechanism is then turned by means of the energy of the spring *D*. This serves to energize the magneto and deliver current to the spark plug. As the engine shaft is turned, the cam *F* operates in the usual manner to periodically make and break the circuit at *G*, and thus explode the successive charges in the engine cylinder, but the power belt *B* turns idly because it operates on a loose pulley.

After the engine has attained a sufficient degree of speed, the lever *C* is thrown to normal position, indicated by broken lines, disconnecting the spring-operated mechanism and coupling the armature with the power belt *B*. The inventor of this mechanism is Mr. Lorenzo D. Stamps, care of F. M. Hamilton, Anahuac, Texas.

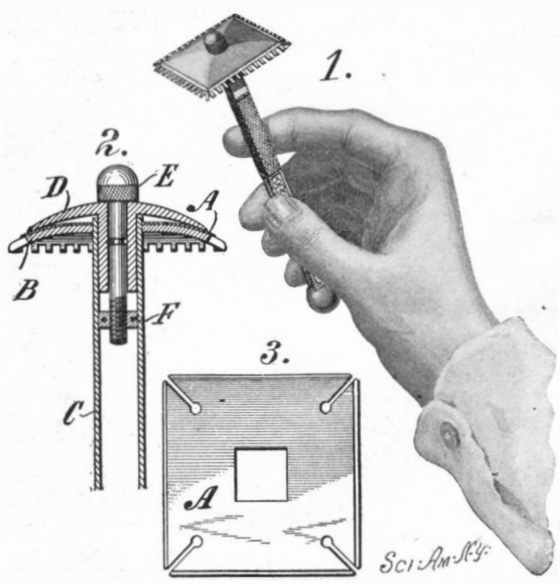


SPARK-PRODUCING MECHANISM FOR EXPLOSION ENGINES.

NOVEL SAFETY RAZOR.

With a view to increasing the life of the razor blade and prolonging the interval between honings, Mr. Edward Krusius, of No. 896 Third Avenue, New York, has invented a safety razor with four cutting edges. An illustration of this novel razor is reproduced herewith. The razor blade, as shown best in Fig. 3, consists of a square plate of steel which is thin enough to be quite flexible. Each edge of the plate is sharpened and, in order to permit the cutting edges to be flexed independently of each other, they are separated by diagonal slots cut inward from each corner. The blade support consists of a square plate, *B*, somewhat dished in order to provide a convex upper surface. The edges of this plate are indented to form guards. The plate *B* is supported on a tubular handle, *C*, which is of square cross section. The handle projects slightly above the convex face of the plate and provides a key which fits into the square central opening in the razor blade, *A*. The backing for the razor blade is shown at *D* and consists of a square plate provided with a square shank which fits into the hollow handle, *C*, so as to hold it against turning, but at the same time permit it to slide in the direction of the length of the handle. The backing is held in place by means of a thumb screw, *E*, which passes through a central bore in the shank and engages a nut, *F*, secured in the handle, *C*. The backing, *D*, is provided with a concave under surface so that it engages the razor blade, *A*, near the cutting edges. It will be evident that the blade may be bent down onto the plate, *B*, and firmly clamped between the backing and the support by tightening the thumb screw. In use the four sides of the razor may be successively used, thus multiplying by four the time interval usually required between honings. When it is desired to replace the razor blade with a fresh one, this can readily be done by removing the thumb screw, *E*. Owing to the large number of cutting edges on each blade, the operator can repeatedly shave without changing the blade.

The fishermen round the Scottish coasts are beginning to interest themselves in the internal combustion engine as a means of helping them to compete with the steam drifter. Several motor-propelled boats, states the Motor World, are now to be found on the east coast, the latest to be put into service being an Eyemouth boat, fitted with a three-cylinder kerosene motor, constructed by Messrs. McBain Brothers, of Alnwick. This vessel was driven round from Eyemouth to Anstruther the other day at a speed of fully eight knots.



A NOVEL SAFETY RAZOR.

RECENTLY PATENTED INVENTIONS.

Pertaining to Apparel.

GARMENT-FORM.—ANNA L. TRAVISS, Virginia, Minn. This apparel apparatus comprises a garment form for use in dressmaking establishments, stores, homes, and other places, and is arranged to display a garment to the fullest advantage, to preserve its shape, and to permit of conveniently folding the garment form into comparatively little space when not in use.

Electrical Devices.

ELECTRICAL CUT-OUT.—P. T. MCNALLY, Mandan, N. D. This device is especially intended for turning on and off any one or more of a system of arc lamps, operated by a single alternating current dynamo, where it is not profitable to make a separate line circuit from the power house, or install a separate alternator for operating the arc lamps and incandescent lamps. It shuts off transformers when not in use, thus preventing loss of power in idle transformers, or for any other analogous purpose.

Of Interest to Farmers.

FEED-TROUGH.—G. D. KOEHLER, Macedonia, Iowa. The invention comprises a trough proper which forms the base of the feeder as a whole, and a part which is hinged thereto and consists of a hopper, for receiving the feed and a series of transverse partitions arranged on the sides of the hopper and dividing the feeding space of the trough so as to form a series of what may be called "stalls," each adapted to accommodate the head of a single animal. The trough may be constructed double or single and easily and quickly cleaned.

GATE.—J. M. HIGBE, Manson, Iowa. The object of this invention is to produce a gate which can be formed of wire or similar light material, and to provide a construction which will prevent the gate from sagging without necessitating a construction involving the use of a heavy frame for the gate. It relates to gates such as used in the fencing of farms and gardens.

GATE.—E. J. A. RICE, Harvard, Neb. One of the several objects of this invention is to provide a construction of farm gate, or that class of gates adapted to be opened by a person approaching it and closed by a person after having passed through the gate, no matter whether such person is on foot, mounted, or seated in a vehicle.

COMBINED COTTON CHOPPER AND CULTIVATOR.—R. H. PURNELL, Rosedale, Miss. The invention is a machine for chopping, or cutting out, cotton rows at regular intervals, and also for throwing dirt up to the plants which remain standing. The runners will always rest and travel upon the ground, and if the team be large, or tall, the front end of the frame will be held higher. This insures the chopper striking the row of plants squarely, or at right angles thereto.

Of General Interest.

POWDER-COMPACTING DEVICE FOR DRUGGISTS.—O. WARE, Muskogee, Ind. Ter. This invention pertains to a device for facilitating the subdivision of powder into smaller portions to be put up in papers or capsules according to the requirements of the prescription being filled by the druggist, and has for its object to compact the powder into a regular sized body whereby the druggist may more easily estimate the proportional parts and may subdivide the powder into any number of parts of equal size.

BAGASSE-FURNACE.—F. F. WILLEMS, Delanggoe, Soerakarta, Java. The invention relates to improvements in furnaces, and more particularly to furnaces adapted for the burning of bagasse, the fiber refuse of sugar cane discharged from the juice-extracting machinery. The bagasse may be dried before reaching the grate bars, and may thus be utilized more economically as a fuel.

CONCRETE STEEL SUSPENSION-ARCH.—E. J. SCHAUWECKER, Clay City, Ind. The object of the inventor is to provide means adapted to enable concrete arches to be constructed with a much larger span than is practical at the present time, with less concrete and with a smaller rise. By means of the construction the arch may be made with a span of any desired length.

ANCHOR FOR AIR-SHIPS.—D. THOMAS, San Francisco, Cal. One purpose of the inventor is to provide an automatic anchor particularly adapted for use in connection with buoyant vessels to effect a landing at a given point quickly and accurately, and to so construct the anchor that when it has entered the ground claws will be forced out into the ground when the anchor is subjected to upward strain, preventing the anchor from being withdrawn or dislodged until the means are operated for permitting the claws to be drawn out.

HORN-SUPPORT.—V. H. RAPKE, New York, N. Y. One object in this case is to provide in the construction of a supporting device particularly for phonograph horns, a novel and simple clamping device that may be readily engaged with a molding of the machine casing, and to provide a supporting rod so constructed that the horn may be supported vertically or horizontally, or. in other words, a universal or interchangeable supporting rod.

BAG-LOCK.—L. B. PRAHAR, New York, N. Y. A purpose of the invention is to furnish a friction lock or latch for purse frames, being particularly adapted to the frames of what is known as hand or wrist bags, which lock or latch is intended to be more simple, durable, and economic to manufacture than any of its class now in use.

SYRINGE-NOZZLE.—H. F. ONG, Portland, Ore. The aim of the inventor is to provide a nozzle for fountain syringes or douches, in which a tube having a catheter pointed extremity is provided with an attached bulb, but is not in communication therewith, the tube being adapted to enter the cavity of organs, permitting the inflowing liquid to leave the nozzle at an angle with sufficient current and force to be highly serviceable in agitating any and all fluid in the cavity at any time in its use.

MEANS FOR RECOVERING SUBMARINE BOATS.—E. OSWALD, United States Navy. The invention is an improved means for the recovery of lost submarine boats, designed to place the location of the submarine with certainty in both day and night, permitting communication with those imprisoned therein and obtaining a hawser attached to the boat without the use of divers. It can be installed on boats already built or now building at a small cost.

DEVICE FOR PROTECTING SAFE-VAULTS.—E. V. LORIG and U. G. GRAHAM, South Omaha, Neb. An object of the invention among others is not only to provide a means to act with certainty in giving alarms, but also at the same time to extinguish fire which can be in or near its location at the time the alarm is sounded, and at the same time by the generation and distribution of noxious gases, drive away burglars or other unauthorized persons.

POST-HOLE DIGGER.—R. T. JENNEY, De Pere, Wis. There is provision in this invention for a simple, durable, economic, and easily operated post-hole digger, one wherein the blade-carrying portion or body is constructed in but two parts, and wherein further the entire structure may be made exceedingly light without sacrificing strength.

SUSTAINING DEVICE FOR AERIAL VESSELS.—I. GRUBER, New York, N. Y. It is sought by this inventor to provide a penumatic device capable of operation from within a basket or car of a balloon to direct the balloon in one or the other direction or to prevent a too rapid descent of the balloon in the event of a leakage of gas or should the balloon be prone to drop from other causes.

APPARATUS FOR COOLING OR HEATING BEER.—E. A. APPELL, New York, N. Y. The object of the invention is to provide an apparatus for use in breweries and other establishments, and designed for cooling beer and like liquids in a very simple and rapid manner, or for heating fluids by the use of steam or like heating medium.

Hardware.

DOOR-FASTENER.—M. D. MERRING, East Stroudsburg, Pa. The object of the inventor is to provide means effective in operation and durable in use, adapted to securely fasten a door so as to prevent it from being opened from the outside. The device is inoperative when not in use by folding the lower section against the upper, and as a spring passes over the hinge joint it is stretched and again contracts, thereby pulling the brace sections firmly together.

WRENCH.—F. C. MAGENHEIMER, Evansville, Ind. In the operation of this monkey-wrench the shaft may be partially rotated by its handle which projects from it a point midway between the upper and lower loop frames, and as it is turned it will operate upon blocks in such manner as to draw the serrations, and to free said serrations from engagement as may be desired.

NUT-LOCK.—C. C. HALGREN, New York, N. Y. The direction of this invention is to improvements in nut locks relating to that type of nut lock embodying in its construction a helical nut. When the nut is threaded upon the bolt and forced to its seat, its threads will automatically be forced into tight embrace with the threads of the bolt and thus securely lock them together.

GAGE.—G. W. MCLAUGHLIN, Hoquiam, Wash. This invention relates to gages of the type adapted for discovering irregularities in the cutting edges of saws, and it is an object of the inventor to provide a gage which is particularly adapted for use in gaging saws with curved cutting edges, such as cross-saws and the like.

Heating and Lighting.

SAFETY DEVICE FOR GAS-BURNERS.—A. A. CHURCHILL, Portland, Ore. The improvement pertains to a device designed for the prevention of accidents resulting from the accidental escape of gas due to a failure to light same when it is turned on, or due to the gas having been blown out after being lighted. The object is to provide a device for closing an electric circuit and ringing a bell or operating any other indicator when unburned gas escapes from the gas jet.

APPARATUS FOR PRODUCING MIXTURES OF GASES OR OF GAS AND AIR FOR ILLUMINATING PURPOSES.—H. L. KARGER, 26 Frankfurter Allee, Berlin, Germany. In accordance with the present invention, the two admission devices for gas and air respectively which are dependent upon the operation of the suction and forcing appliances, are arranged behind the admission aperture common to them both, in such a manner that during the admission to the suction chamber the gas and air mutually penetrate each other. Novel arrangement of valves secures a number of advantages.

HEATER.—H. F. LANGENHOP, New York, N. Y. The object in this instance is to provide a stove or heater arranged to utilize heat arising from the burning fuel in the fire-box to the fullest advantage, to heat a room by radiation of heat from the stove or heater, and to heat water, air, or both and conduct it to radiators or registers for heating other rooms and to assist in heating the room in which the heater is located.

Household Utilities.

CUSPIDOR-CLEANER.—O. KEROUSE, San Francisco, Cal. This inventor's improvement is a contractible and expansible device adapted for cleaning cuspidors and other receptacles or tubular bodies, especially those whose mouths or entrant portions are contracted or made of less diameter than the body portion. The rubbing and cleaning is done in a rapid and effective manner.

Machines and Mechanical Devices.

LABELING-MACHINE.—F. X. MALOCSAY, New York, N. Y. The principal objects of the invention are to provide means whereby an adhesive can be applied to cans or other articles, to provide for thereafter feeding and applying labels to the cans successively onto the portion supplied with the adhesive, and to provide means for manipulating the several essential parts of the machine and feeding the cans, both before and after the labels are applied.

BRICKMAKING-MACHINE.—E. L. MARTIN, Woodburn, Iowa. The invention has reference to machines for making bricks, and is especially adapted to be operated by hand. The object of the invention is to simplify and improve the machine, and the finished bricks removed by a single operation of one lever.

ELEVATOR.—C. A. LINDSTROM, Seattle, Wash. This improvement relates to elevators designed to be used for stacking lumber, and has for its object to provide means simple in construction, effective in operation and durable in use, adapted to be moved about in a yard and to elevate and deposit lumber at any desired height to form a stack.

COLLAR.—D. J. KELLY, Aberdeen, Wash. The invention is an improvement in collars as used on the shafting of machinery, especially shafting likely to come in contact with the clothing of workmen and others. An object is the production of a means to be placed over the ordinary collar as now in use for covering the set-screw head which is the source of much danger and many accidents.

PLUNGER FOR BOTTLE-MACHINES.—R. JOHNS, Fairmount, W. Va. The purpose of the invention is to provide an improved construction of plunger whereby to preserve a proper and uniform degree of temperature necessary to the successful operation of such plungers as are commonly used as a part of machines and presses employed in the manufacture of bottles, jars, and other tubular glass ware.

POWER-SHOVEL. — R. BELDEN, Spanish Ranch, Cal. Mr. Belden's invention has reference to improvements in power shovels for digging railroad beds, ores, ditches, and the like, the object being to provide a power-shovel of comparatively simple construction by means of which the work may be rapidly carried on.

RATCHET-POWER.—J. H. HARDEN, Anniston, Ala. The invention refers to means, manual or mechanical, whereby to convert applied reciprocal motion into rotary motion, and has for its object peculiar, novel, and improved means for the purpose stated, involving rotatable shafts operatively connected by suitable gearing, and a novel form of ratchet power devices.

Prime Movers and Their Accessories.

AUTOMATIC DRAINAGE ATTACHMENT FOR LUBRICATORS.—J. C. HUBBARD, Georgetown, S. C. The invention relates to an improvement in lubricators for steam engines in which the lubricator is coupled up with the steam pipe for a regulated feed. As lubricators of this type contain water it frequently happens that the engineer forgets to open the drain valve of the lubricator when leaving at night, with the result that the lubricators freeze and burst, thereby entailing expense of new ones. The invention prevents this possibility. Mr. Hubbard has also received a patent on an invention designed to provide an automatic drainage attachment for each lubricator, which is entirely independent of any separate connection with the boiler and comes into action by the mere act of disuse of the lubricator, or shutting down of the engine.

TRIPLE-EXPANSION ENGINE.—W. S. LYCAN, Marshall, Ill. In the present patent the object of the invention is the provision of a new and improved triple expansion engine, which is arranged to utilize the motive agent to the fullest advantage and without back pressure during the third expansion of the steam.

Railways and Their Accessories.

RAILWAY-TIE.—H. E. MATTHEWS, Salida, Col. The invention pertains to railway ties, and the object is to produce a metal tie of simple construction having a special form which facilitates the fastening of the rails thereto, and which tends to prevent a lateral displacement of the tie in the roadbed.

Pertaining to Recreation.

SNAPPING DEVICE FOR MARBLES.—W. L. HOFFMAN, Jersey City, N. J. The device is grasped in the hand, and by pressure of the latter the marble may be projected as when snapped from the fingers. The inventor's object is to produce a device adapted to be used in playing marbles, and enables the marbles to be snapped with greater force and accuracy than in the ordinary way.

TRANSFORMABLE TOY.—MARY A. GLEN, Elizabeth, N. J. The toy is primarily in sheet form and adapted to be cut out, folded, glued, and the parts connected to produce a transformable object. Objects may be produced upon sheets of paper, pasteboard, metal, or other material, manufactured, issued, or published separately, or in book form, or other form, and printed, drawn, stamped, or painted in colors or otherwise, with single, double, compound, or separate figures or parts, animals, creatures, or the like, which, after being made up, when turned inside out or about, will show different figures of persons, animals, creatures, or objects.

Pertaining to Vehicles.

VEHICLE-WHEEL.—J. B. HUNTER, Pittsburg, Pa. The object of the invention is to provide a construction of wheel in which the rim is cushioned with respect to the hub, special features being an octagonal metal hub, an outer rim, an inner ring, spokes between the rim and ring, and radial spiral springs between the hub and ring allowing free vibrations in all directions radial to the hub, four annular metal plates being fitted between the hub and the ring and lapped and bolted together so as to brace the wheel in all directions.

AUXILIARY FELLY AND TIRE.—C. BUCKLAND, Habana, Cuba. The invention relates to wheels having inflated pneumatic tires. The object is to provide means adapted to be readily attached to or removed from vehicle wheels of ordinary construction, and when applied thereto to protect the pneumatic tire from injury without interfering with the resiliency of the tire.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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Minerals sent for examination should be distinctly marked or labeled.

(10567) W. W. R. writes: We have an artesian well here about 1,000 feet deep that is throwing out salt and white sulphur water at the rate of 400 gallons per second. This is correct. I tested it three different times, and made it that or a little over. I am satisfied it will rise in a 6-inch pipe 30 to 50 feet, and probably higher. With say a rise of 30 feet, what horse-power will it make with a turbine wheel, and what size wheel will it take to run a flouring mill, or will it do it at all? Our town has a population of 600, and could we light the town with the power from well? Say eight large electric lights and 400 incandescent lights for stores and dwellings. A. Four hundred gallons of water per second at a pressure equal to a head of 30 feet would develop 180 horse-power. The number of pounds of water per second, multiplied by the head and divided by 5,500 will give you the theoretical power. If this flow of water could be constantly relied on, from 75 to 80 per cent of the above horse-power could be generated by a turbine wheel, which would be sufficient to light your town, with considerable margin to spare. It is very doubtful if your well will continue its present output at the pressure which you mention for a great length of time. We would advise you, therefore, to get an expert's opinion on this point before making any large investment.

(10568) C. H. M. says: What is the formula for finding the horse-power required

to run an air compressor, given the following: The internal dimensions of the cylinder, the speed, and the maximum internal pressure, or the pressure at which the air is delivered from the compressor. A. The horse-power required to run an air compressor, neglecting friction, equals the area of the cylinder in square inches multiplied by the internal pressure per square inch, multiplied by the number of feet which the piston moves per minute, and the whole divided by 33,000. Taking friction into account, the power necessary would be nearly double this amount. 2. In finding the exact horse-power required, would the external pressure be considered? A. In determining the exact horse-power, the difference in pressure of the two sides of the piston in pounds per square inch is the figure that should be used. 3. Of what advantage is a several-staged compressor over a single-staged one? A. A several-staged compressor has the following advantages: The air is compressed less in each cylinder, and therefore a larger amount of air can be forced out of each cylinder per stroke. The valves work more satisfactorily, and there is less leakage, because the difference in pressure on the two sides is less. Second, a small amount of leakage does less harm. The increase in temperature due to the compression in each cylinder is less, and the air may be cooled between the various stages of the compression. The work is more uniformly distributed throughout the entire stroke, making the compressor run more smoothly. 4. What would be the formula for finding the horse-power required for a two, three, or four stage compressor? A. The horse-power of the two, three, or four stage compressor is found by first finding the horse-power of each cylinder, by the method already explained, and adding these amounts together. 5. Is there a formula for computing the horse-power of a steam turbine, given the steam or air pressure and the number of cubic feet of steam or air delivered per minute at a given pressure? At what pressure will a turbine work most economically? Does a turbine generate as much power with a given amount of steam as a reciprocating engine? A. There is no reliable formula for computing the horse-power of the steam turbine. In general, steam turbines will develop about the same horse-power for a given amount of steam as reciprocating engines. A small power turbine at 120 pounds steam pressure non-condensing, will require 40 or 45 pounds of steam per horse-power per minute. On the other hand, a larger turbine, designed so as to get the full benefit of the expansion of the steam, when working with steam at 180 pounds pressure and condensing, may be operated with about 16 or 18 pounds of steam per horse-power per hour. The higher the steam pressure, the more economical will be the turbine.

(10569) W. M. says: I wish to experiment with compressed air, and desire a little information on that subject. Air compressed to a density of 50 pounds to the square inch and admitted to a cylinder 3 inches in diameter for a distance of 2 inches, how far will the piston travel before losing all its expansive force? Also, at 100 and 200 pounds to the square inch? A. When air expands, its *absolute pressure* decreases in the same proportion that its volume increases, so long as the temperature remains constant. The absolute pressure is found by adding 15 pounds—the atmospheric pressure—to the pressure which is shown by the gage. Thus, if one cubic foot of air at 50 pounds pressure expands to two cubic feet, the absolute pressure after expansion will be $50+15\div2=32.5$. This equals a pressure of $32.5-15=17.5$ pounds above the atmosphere. In the same way, if the volume were increased to 3 cubic feet, the final pressure would be $50+15\div3=21.6$. This equals a pressure of 6.6 pounds above the atmosphere. This rule can be applied to any pressure and to any change in volume, so long as the temperature remains constant. The rule does not exactly apply to compressed air in the cylinder, because the temperature of the air decreases when the air expands, and this decrease in temperature decreases the pressure somewhat by the figures given by the above rule. Where the expansion is not carried too far, however, the above rule gives results which are approximately correct. If the fall in temperature is known, the final pressure, as determined by the above rule, may be corrected by multiplying it by the following formula: $\frac{460+t1}{460+t2}$ where $t1$ equals the temperature of the air in degrees Fahrenheit at the end of the expansion, and $t2$ equals the temperature of the air in degrees Fahrenheit at the beginning of the expansion.

(10570) W. T. H. asks: Can you tell me if there is any machine invented or patented (or in use) to produce power by any of what are called the mechanical powers, such as the wedge, the screw or lever, as a motor solely without any other agent whatever, such as air, water, electricity, heat in any form or chemicals; simply a mechanical motor to drive or operate machinery? I do not mean the perpetual motion fiend business, but something to push and pull with for something. A. We do not know of any motor as a generator of power such as you call for, but a lever or any other of the mechanical powers, by the aid of a weight, acting under gravity, will generate power and comes within the limits of your question. They do not use air, water, heat, electricity, or chemicals, but only gravity. They may drive machinery also, but the weight will have to be wound up again after it has run down to its limit. A clock is a machine so driven, and comes well within your requirements. Nor is it a perpetual motion machine.

(10571) C. S. asks: At what pressure does acetylene gas begin to liquefy, and what chemical can be used to purify it so that a pressure of 200 pounds can be used safely? A. The critical pressure of acetylene is 750 pounds. The critical temperature is quite high, so that it will liquefy in the tank by compression. The tanks contain asbestos disks which are saturated with acetone.

(10572) H. C. D writes: In a quotation from the Chemical News, in your issue of May 25, there is a statement that the temperature of dissociation of water is probably about 2,500 deg. C. Water decomposes at a temperature less than that of melting platinum. Following Holleman's "Inorganic Chemistry," I used a liter flask having a stopper and delivery tube. Through the stopper extended two copper wires. Connecting these just above the water was a coil of No. 26 platinum wire. A 110-volt current was used with a rheostat giving varying resistance. With the rheostat set to deliver about 14 amperes the wire melted. With it set to deliver 12 amperes I was able to collect a mixture of hydrogen and oxygen, shown by its explosiveness. The current actually used was not measured. The water was boiling during the experiment. The melting point of platinum is usually given as 2,000 deg. C., which would make the decomposition temperature of water something less than 2,000 deg. C. A. It is quite true that water begins to be dissociated at a temperature considerably below that of the melting point of platinum, but the process is not completed till considerably above the melting point of platinum. It is commonly taken to begin at 1,200 deg. C. and to be complete at 2,500 deg. C. Dissociation does not take place suddenly, but gradually. The melting point of platinum is given variously by different authorities. The Smithsonian tables give from 1,775 deg. to 2,200 deg. Baker & Co., the large workers in platinum, give the lower figure. A mean figure is 1,900 deg. Had the Chemical News stated the temperature of *complete* dissociation to be 2,500 deg. it would have been more correct.

(10573) M. S. T. asks: Kindly let me know what liquid will expand and contract the most and easiest. A. Ether expands most for a change of temperature of any liquid for which we have data, and acetone is next in the list. Benzene has the lowest specific heat of any liquid for which we have data, and hence will expand easiest.

NEW BOOKS, ETC.

THE VOICE OF THE MACHINES. An Introduction to the Twentieth Century. By Gerald Stanley Lee. Northampton, Mass.: The Mount Tom Press. 12mo.; cloth; 190 pages. Price, $1.25.

A number of more or less rhapsodical essays on the spiritual side of machinery. They mark the passing of the "poet of uselessness," and the advent of the poet who can see beauty in mechanical perfection.

BEAN CULTURE. By Glenn C. Sevey. New York: Orange Judd Co. 16mo.; cloth; 130 pages; illustrated. Price, 50 cents.

A practical treatise on the production and marketing of beans. It includes the manner of growth, soils and fertilizers, best varieties, seed selection and breeding, planting, harvesting, insects and fungous pests, composition and food value; with a special chapter on markets by Albert W. Fulton. A practical book for the grower and student alike.

CELERY CULTURE. By R. W. Beattie. New York: Orange Judd Co. 16mo.; cloth; 147 pages; illustrated. Price, 50 cents.

A practical guide for beginners and a standard reference of great interest to persons already engaged in celery growing. It contains many illustrations giving a clear conception of the practical side of celery culture. The work is complete in every detail, from sowing a few seeds in a window-box in the house for early plants, to the handling and marketing of celery in carload lots.

STEAM TRAPS. By W. H. Wakeman. Jersey City: Joseph Dixon Crucible Company. 16mo.; paper cover.

Many steam-users seem to think that the steam trap is a luxury to be indulged in only by the operators of large plants, who can afford to spend their money on useless contraptions which have nothing in their favor except that they are "the very latest." No device that utilizes a waste-product is a luxury, however slight the saving may be; if the saving is great, the device becomes a necessity. The steam-trap can be placed in this last class, for its saving-power, large as it is under any circumstances, increases with the cost of fuel. The Joseph Dixon Crucible Company, Jersey City, N. J., publish a very interesting pamphlet on the subject of steam traps which should be in the hands of every steam-plant operator. It is an illustrated description of the several varieties, with valuable suggestions by W. H. Wakeman, expert steam engineer and author of well-known books on steam engineering.

TOMATO CULTURE. By Will W. Tracy. New York: Orange Judd Co. 16mo.; cloth; 150 pages; illustrated. Price, 50 cents.

The author has rounded up in this book the most complete account of tomato culture in all its phases that has ever been gotten together. It is no second-hand work of reference, but a complete story of the practical experiences of the best posted expert on tomatoes in the world. No gardener or farmer can afford to be without the book. Whether grown for home use or commercial purposes, the reader has here suggestions and information nowhere else available.

ELECTRIC BELLS, INDICATORS, AND AERIAL LINES. By Umberto Zeda. Translated from the original Italian and revised by S. R. Bottone. Authorized edition. London: Guilbert Pitman. 16mo.; cloth; 120 pages; 109 illustrations. Price, 80 cents.

A knowledge of electric bells is almost a necessity to everyone, so widely are they used. The work of which we are writing gives a progressive account of the modern practice for installing electric bells, indicators, and aerial lines, with particular stress upon the many novelties which the Italians have introduced into the usual ways of working.

LESSONS IN LEATHER WORK. By Marguerite Charles. New York: F. W. Devoe & C. T. Raynolds Co. 16mo.; paper cover; 56 pages. Price, 35 cents.

Although the art of leather-decorating reached a very high stage in the middle ages, and for several centuries following, its possibilities are scarcely realized nowadays. The tools required are not expensive, and the skill necessary to achieve at least passable results can be acquired without excessive practice. The translation of Miss Charles's pamphlet should give an impetus to leather-working that will take away the haunting memories of the "burnt-work" horrors of a year or so ago by the attractiveness of the newer products of the art.

THE EFFECT OF DIET ON ENDURANCE. Publications of Yale University. By Irving Fisher, Ph.D. New Haven, Conn., 1907.

Dr. Fisher's monograph is a valuable contribution to the very scant literature on the subject of endurance. His experiments were conducted largely to verify the claims of Horace Fletcher as to the effects upon endurance of thorough mastication combined with implicit obedience to appetite. Dr. Fisher finds that Mr. Fletcher's claims, so far as they relate to endurance, are justified. The results observed during the experiment may be summarized as a slight reduction of total food consumed, a large reduction of proteid element, especially for fresh foods, a lessened excretion of nitrogen, a slight loss of weight, a slight loss of strength, an enormous increase of physical endurance, and a slight increase in mental ability. The practical value of the experiment consists in the fact that any layman can apply it with or without knowledge of food values.

ONE YEAR'S GROWTH IN THE RAILROAD DEPARTMENT FOR THE YEAR 1906 AND THE OUTLOOK FOR 1907. Issued by the International Committee of the Y. M. C. A., 3 West 29th Street, New York city.

To those unacquainted with the ramifications of the organization, the Year Book of the Railroad Department of the Y. M. C. A. will prove a revelation. With its one hundred and sixty-two buildings, this association reaches a membership of over eighty-four thousand; for the most part men whose lives would be devoid of religious influence if it were not for the opportunities of worship offered by this society. When one sees that the attendance upon religious exercises is above 80 per cent of the total number of members, one can draw some idea of the magnitude of the work carried on.

MECHANICAL TRIANGULATIONS IN FREE-HAND DRAWING. By Frank Aborn. Cleveland, Ohio: Cleveland Publishing Company. 12mo.; paper cover; 44 papes; illustrated. Price, 50 cents.

A description of a method of drawing by triangulation, which, when mastered, enables the pupil to make rapid progress in free-hand drawing. Although best adapted for the copying of objects which are all in one plane, the system can be so modified as to be applicable to subjects having three dimensions. The author's manner of expressing his ideas is rather involved in parts of his work, but the benefit derived is quite worth the slight extra trouble in gaining it.

HISTOLYSE, SANS PHAGOCYTOSE, DES MUSCLES VIBRATEURS DU VOL, CHIEZ LES REINES DES FOURMIS. Extrait des Comptes rendus hebdomadaires des Séances de l'Académie des Sciences. Paris, 1907. T. 144. Pp. 393.

This short but valuable discussion by M. Charles Janet, well known to entomologists for his splendid studies of ant life, is devoted to an analysis of the system of the muscles which are used by ants but once during their lives and then only for a few hours, only to disappear completely after the nuptial flight. Janet concludes from a minute study of the degeneration of the system that these muscles in the queen ant of *Lasius niger* disappear absolutely without any intervention of phagocytosis.

NAVIGATION BY COMPASS. By Clinton S. Bissell, B.A. Flushing, N. Y.: C. S. Bissell. Paper cover; 32 pages. Price, 50 cents.

A splendid little practical book of instruction on navigation by "Dead Reckoning." By its use anyone with a knowledge of sailing should be able to master the details of the art, so clearly are all the operations explained. Since all the necessary tables are contained in the text, there is a saving in time in bringing up the day's work.

SIMPLE PHOTOGRAPHIC EXPERIMENTS. By F. Thorne Baker. London: Percival Marshall & Co. 16mo.; paper cover; 68 pages; illustrated. Price, 25 cents.

A short treatise for such followers of photography as are of an investigative turn of mind. It contains a number of simple, yet most interesting, experiments with photographic materials that anyone can perform however slight his theoretical training may have been. The directions for making sensitized papers, and "orthochromatic plates" place a most important part of photography within the grasp of the amateur.

LIGHT AND SHADE. By the Duffner & Kimberly Company, New York. 16mo.; paper cover.

A really charming little book on Period Decoration, showing how the products of the firm by whom it is published have been developed along harmonious lines. The text is most instructive and readable, and the illustrations are of a very high artistic quality.

THE LONG LEAF PINE IN VIRGIN FOREST. A Silvigil Study. By G. F. Schwarz. New York: John Wiley & Sons. 16mo.; cloth; 135 pages; illustrated.

Like all nations that have had enormous natural resources at their disposal, we have been lavish of our timber supply. Our forests were so widely extended that it seemed absurd to think that they could ever be exhausted. Now we realize that we can hope to have a sufficient supply of lumber for our future needs only by carefully guarding our remaining woodlands. This volume adds to the knowledge of the life-history of a most important forest tree, the "long leaf pine." Along almost the entire southern seaboard, as well as in several isolated areas, this tree is the prevailing timber-growth; its lumber value is correspondingly great. Mr. Schwarz has had admirable opportunities to study the various conditions described in his book, and has produced a work of value to all who take an interest in the welfare of our forests.

REMPLACEMENT DES MUSCLES VIBRATEURS DU VOL PAR DES COLONNES D'ADIPOCYTES CHIEZ LES FOURMIS, APRES LE VOL NUPTIAL. Extract des Comptes Rendus Hebdomadaires des Seances de l'Acadèmie des Sciences. Paris.

The wing-muscles of ants function during a period which may not be more than a few minutes in duration. The investigations of M. Janet show what becomes of these muscles, the most bulky of those which the insect possesses.

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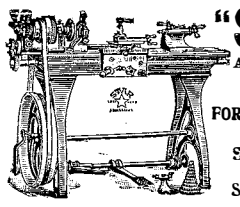

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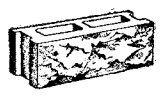

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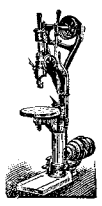

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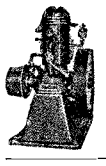

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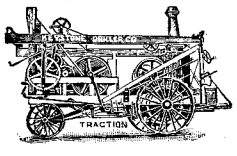

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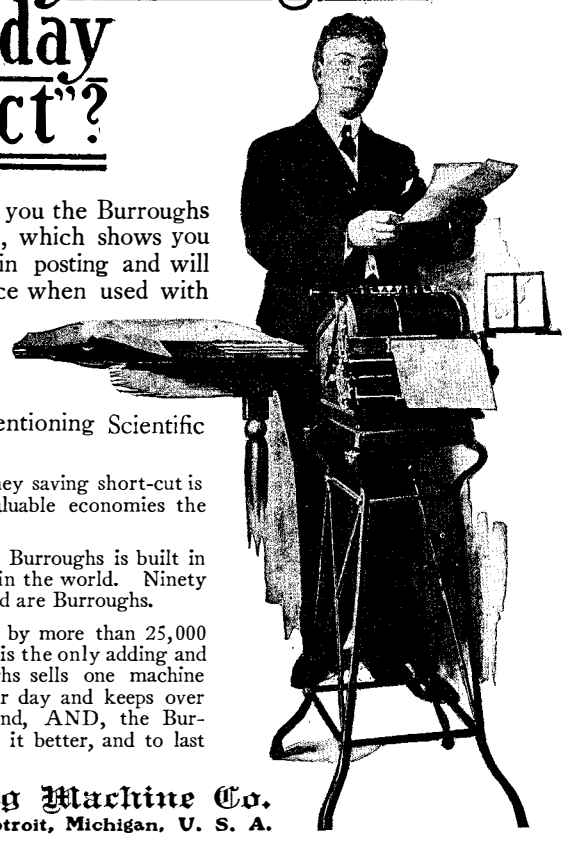

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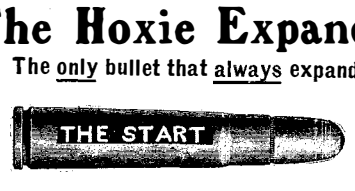

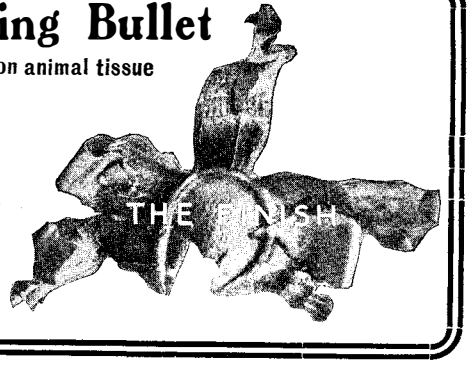

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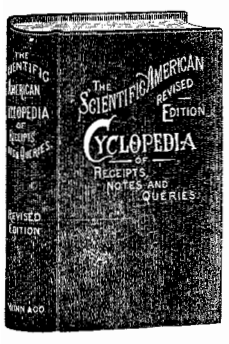

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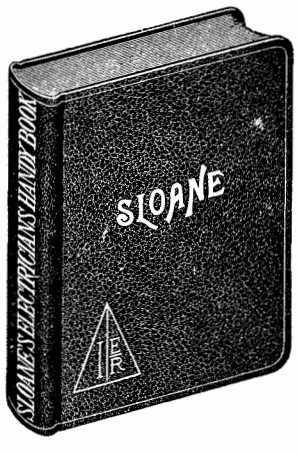

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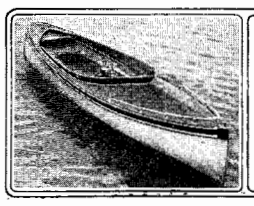

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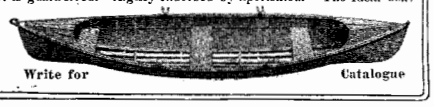

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ALCOHOL

Its Manufacture
Its Denaturization
Its Industrial Use

The Cost of Manufacturing Denaturized Alcohol in Germany and German Methods of Denaturization are discussed by Consul-General Frank H. Mason in SCIENTIFIC AMERICAN SUPPLEMENT 1550.

The Use, Cost and Efficiency of Alcohol as a Fuel for Gas Engines are ably explained by H. Diederichs in SCIENTIFIC AMERICAN SUPPLEMENT 1596. Many clear diagrams accompany the text. The article considers the fuel value and physical properties of alcohol, and gives details of the alcohol engine wherever they may be different from those of a gasoline or crude oil motor.

In SCIENTIFIC AMERICAN SUPPLEMENT 1581 the **Production of Industrial Alcohol and its Use in Explosive Motors** are treated at length, valuable statistics being given of the cost of manufacturing alcohol from farm products and using it in engines.

French Methods of Denaturization constitute the subject of a good article published in SCIENTIFIC AMERICAN SUPPLEMENT 1599.

How Industrial Alcohol is Made and Used is told very fully and clearly in No. 3, Vol. 95, of the SCIENTIFC AMERICAN.

The Most Complete Treatise on the **Modern Manufacture of Alcohol,** explaining thoroughly the chemical principles which underlie the process without too many wearisome technical phrases, and describing and illustrating all the apparatus required in an alcohol plant is published in SCIENTIFIC AMERICAN SUPPLEMENTS 1603, 1604 and 1605. The article is by L. Baudry de Saunier, the well-known French authority.

In SUPPLEMENTS 1607, 1608, 1609 we publish **a digest of the rules and regulations** under which the U. S. Internal Revenue will permit the manufacture and denaturation of tax free alcohol.

A Comparison of the **Use of Alcohol and Gasoline in Farm Engines** is given in SCIENTIFIC AMERICAN SUPPLEMENTS 1634 and 1635 by Prof. Charles E. Lucke and S. M. Woodward.

The Manufacture, Denaturing and the Technical and Chemical Utilization of Alcohol is ably discussed in the SCIENTIFIC AMERICAN SUPPLEMENTS 1636 and 1637 by M. Klar and F. H. Meyer, both experts in the chemistry and distillation of alcohol. Illustrations of stills and plants accompany the text.

The Sources of Industrial Alcohol, that is the Farm Products from which alcohol is distilled, are enumerated by Dr. H. W. Wiley in SCIENTIFIC AMERICAN SUPPLEMENTS 1611 and 1612 and their relative alcohol content compared.

The Distillation and Rectification of Alcohol is the title of a splendid article by the late Max Maercker (the greatest authority on alcohol), published in SCIENTIFIC AMERICAN SUPPLEMENTS 1627 and 1628. Diagrams of the various types of stills in common use are used as illustrations.

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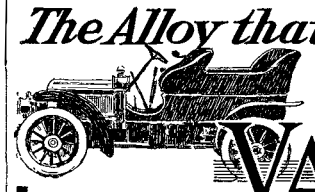

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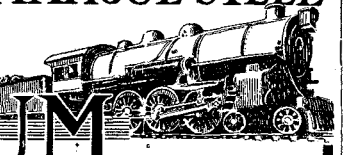

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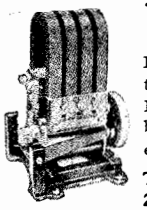

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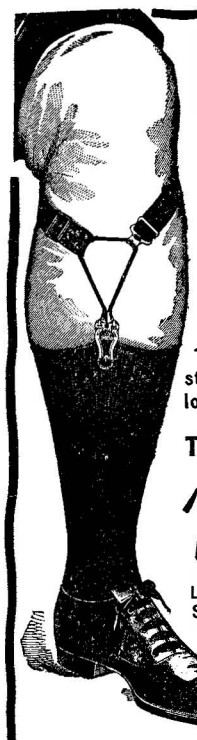

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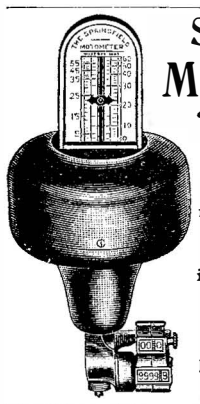

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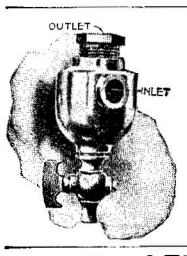

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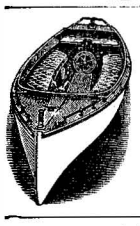

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Oils, lubricating, Atlantic Refining Co.	63,160
Olives and olive oil, American Olive Co.	63,253
Overalls and jumpers, Hooker Corser & Mitchell Co.	63,232
Packing materials for preventing leakage of fluids, Chicago Bailey Co.	63,141
Paint and varnish driers, Lefranc & Co.	63,174
Paints and painters' materials, certain, L. H. Baekeland	63,259
Paints and varnishes, mixed, "Le Ripolin," (Societe Anonyme Francaise de Peintures Laquees et d' Enduits Sous-Marins. Procedes Lefranc & Briegleb Reunis)	63,314
Panoramic views, apparatus for the vision of, Societe Anonyme Periphote et Photorama	63,292
Paper bags, Union Bag and Paper Co.	63,180
Paper bags, Cleveland-Akron Bag Co., 63,188, 63,189, 63,213 to	63,215
Paper, ledger index bristol, D. L. Jones & Co. 63,166,	63,167
Paper, writing and printing, George La Monte & Son	63,142
Papers, bond, ledger, linen, and writing, Union Card and Paper Co.	63,181
Papers, wrapping, tissue, news, book, and press, J. L. N. Smythe Co.	63,275
Pavements, bituminous concrete, Barber Asphalt Paving Co.	63,140
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Remedies for certain diseases, L. J. Cote, 63,164,	63,165
Remedies for certain diseases, Microline Medicine Co.	63,283
Remedies for lung and throat diseases, W. J. Sibley	63,291
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Remedy for certain diseases, V. Schmidt	63,290
Remedy for grippe, J. T. Morgan	63,285
Remedy for venereal diseases, I. T. Duncan	63,267
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Rugs and carpets, Eden Manufacturing Co., 63,225 to	63,227
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Tonic, reconstructive, Davis Chemical Co.	63,224
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Whips, Horse Whip Co.	63,233
Whisky, Rieger & Lindley	63,179
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Whisky, H. C. Woodbury	63,251
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Whisky, gin, and brandy, Figge-Doyle Co.	63,228
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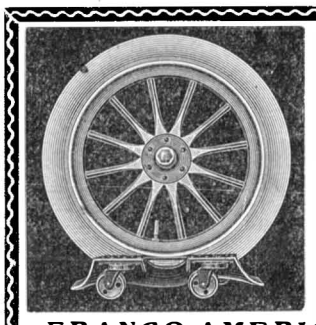

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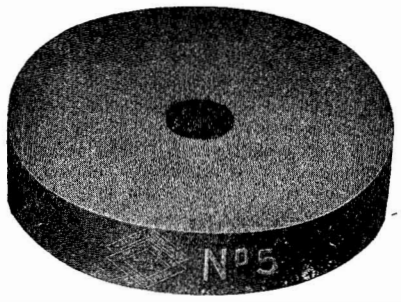

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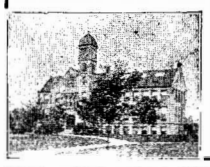

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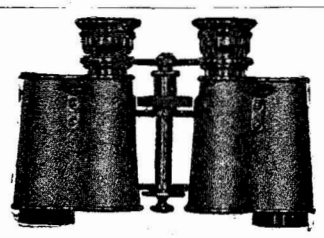

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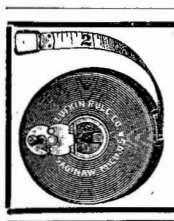

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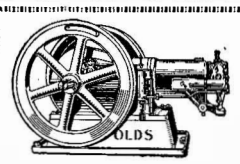

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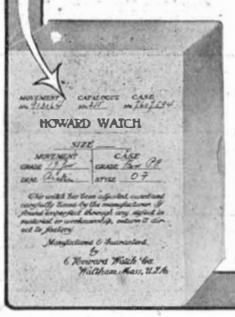

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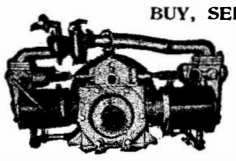

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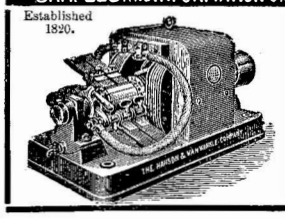

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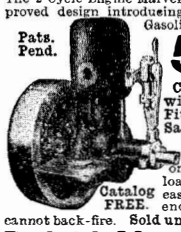

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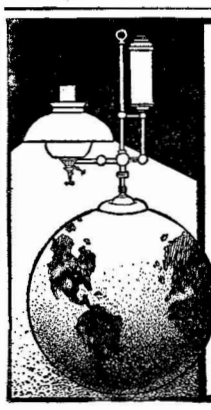

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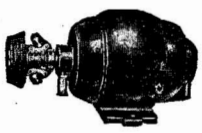

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